Total No. of Questions : 4]

SEAT No. :

P1344

[Total No. of Pages : 2

[4226] - 301

M.Sc.

BIOCHEMISTRY

BCH - 370 : Molecular Biology

(2008 and 2010 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat labelled diagrams wherever necessary.***

Q1) Answer any four of the following : **[20]**

a) What are the enzymatic activities and role of DNA polymerase I?

b) How the damage caused to DNA by uv radiation is repaired?

c) Describe the role of rec A protein?

d) What is DNA foot printing technique? What is its application in transcription studies?

e) Explain the proof reading activity of amino acyl t - RNA synthatase.

Q2) Answer any two of the following : **[20]**

a) Describe the events involved at replication fork during its formation and progression .

b) What are histones? What are the different types? Explain their role in chromatin organisation.

c) What is the promoter structural features in eukaryotic transcription? Comment upon the role of transcription factors.

Q3) Give a short account on the following (any four) : **[20]**

a) Capping of messenger RNA.

b) Recombinase enzyme and its role.

c) Termination of transcription mediated by rho protein

d) Initiation of bacterial protein synthesis.

e) Multiplication of HIV virus.

P.T.O.

Q4) Write short notes on (Any Four) : **[20]**

a) Targeting of proteins to chloroplast.

b) Ubiquitin protein and its role.

c) Zinc finger domain and its significance.

d) Retrotransposons

e) Base excision repair mechanism.

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Total No. of Questions : 6]

SEAT No. :

P1345

[Total No. of Pages : 2

[4226] - 302

M.Sc.

BIOCHEMISTRY

BCH-371 : Medical Biochemistry and Immunology

(2008 and 2010 Pattern) (Sem. - III)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

(Medical Biochemistry)

Q1) Answer any three of the following : **[15]**

a) What are hallucinogens? Give their features.

b) Elaborate on physiological role of hydrolytic enzymes of lysosomes.

c) Explain in detail, mechanism that leads to activation of fibrinogen to fibrin.

d) What are antibiotics? Give the mechanism of any two that affect transcription process.

Q2) Answer any three of the following : **[15]**

a) Give details of various cellular components of blood.

b) Elaborate on the molecular basis of hemoglobinopathies with suitable example.

c) Discuss the etiology and treatment of myocardial infarction.

d) Describe the cascade mechanism that leads to programmed cell death.

Q3) Write notes on any two of the following : **[10]**

a) Carcinogens.

b) Biochemistry of Alzheimer's disease.

c) CSF.

P.T.O.

SECTION - II

(Immunology)

Q4) Answer any three of the following : **[15]**

a) Elaborate on the steps involved in the production of monoclonal antibodies.

b) How does innate immunity differ from acquired immunity? Give examples.

c) List out the types of Hypersensitivity reactions and give their features.

d) Differentiate between RIA and ELISA techniques.

Q5) Answer any three of the following : **[15]**

a) Explain in detail structural features of IgG.

b) Discuss the etiology and development of AIDS.

c) Elaborate on biochemical basis of autoimmune diseases.

d) Show the steps involved in complement activation via classical pathway.

Q6) Write notes on any two of the following : **[10]**

a) Immunodiffusion.

b) Western blotting.

c) Attenuated Vaccines.

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Total No. of Questions : 4]

SEAT No. :

P1346

[Total No. of Pages : 2

[4226] - 303

M.Sc.

BIOCHEMISTRY

BCH-372 : Neurochemistry

(2010 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw necessary diagrams wherever necessary.***

Q1) Answer any four of the following : **[20]**

a) Define and identify on a diagram of a neuron, the following regions: dendrites, axon, axon hillock, soma and synaptic cleft.

b) Describe the roles of the cerebellum in the regulation of skilled movement.

c) What are fundamental differences between Chemically Gated and Voltage-Gated Channels?

d) Explain the characteristics of a neurotransmitter.

e) Differentiate main functional properties of electrical and chemical synapses.

Q2) Answer any two of the following : **[20]**

a) Explain the structure of the hypothalamus, including the major hypothalamic nuclei.

b) Describe chemical neurotransmission, listing in correct temporal sequence events beginning with the arrival of a wave of depolarization at the pre-synaptic membrane and ending with a graded potential generated at the post-synaptic membrane.

c) Explain the synthetic pathways, inactivation mechanisms and neurochemical anatomy and mechanisms of receptor transduction for the following neurotransmitters :

i) Catecholamines

ii) Acetylcholine

P.T.O.

Q3) Answer <u>any two</u> of the following : **[20]**

a) Explain the mechanisms proposed for short term and long-term memory storage.

b) Draw a cross section of the spinal cord and discuss the organization of the sensory and motor components of gray matter. Describe the somatotropic arrangement of motor neuron pools.

c) Explain the effects of altering either the intracellular or extracellular Na^+, K^+, Cl^-, or Ca^{2+} concentration on the equilibrium potential for that ion.

Q4) Write short notes on any four : **[20]**

a) Synaptic plasticity

b) Blood-brain barrier

c) Olfactory receptors

d) GABA Receptor

e) Retina

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Total No. of Questions : 4]

SEAT No. : ____

P1347

[Total No. of Pages : 2

[4226] - 304

M.Sc.

BIOCHEMISTRY

BCH - 373 : Biochemical Toxicology

(2008 & 2010 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) Answer any five of the following : **[20]**

a) What are the different areas of toxicology? Explain their roles.

b) What do you mean by poison? How toxicants are classified?

c) Explain various mechanisms by which toxicants cause the cellular injury.

d) Give details about the Dose-Response relationship.

e) Distinguish between i) local and systemic toxicity. ii) poisonous and venomous animals.

f) Explain in brief the allergic reaction and idiosyncratic reactions.

g) Selective toxicity of toxic agents is due to biologic diversity. Explain.

Q2) Attempt any five of the following : **[20]**

a) What are the acute toxic effects of organophosphorus insecticides?

b) Explain how carbaryl is biotransformed in the body.

c) Give the site and mechanism of toxic action of DDT.

d) Enlist the toxins secreted by amphibians and mode of their toxic effects.

e) What are the general toxic effects of solvents and vapors.

f) How mutagenic potential of toxic substance is evaluated?

g) What measures you would suggest to prevent the occupational hazard?

P.T.O.

Q3) Answer any four of the following : **[20]**

a) Explain the mechanism of glutathione S-transferase catalyzed biotransformation.

b) Give two examples of metabolic activation of xenobiotics that leads to cellular injury.

c) Explain the various types of antagonism.

d) Give the composition of snake venom.

e) What are the clinical applications of toxicology.

f) How oxidative type of air pollution is formed?

Q4) Give the pathogenesis and clinical manifestations of any four of the following: **[20]**

a) Hematopoietic effects of benzene.

b) Perivascular disease caused by chronic exposure of arsenic.

c) Micromercurialism by inhalation of mercury vapors.

d) Chronic obstructive disease due to cadmium exposure.

e) Encephalopathy by lead exposure.

f) Acrodynea by mercurous salts.

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Total No. of Questions : 6]

SEAT No. :

P1348

[Total No. of Pages : 3

[4226] - 401

M.Sc. (Sem. - IV)

BIOCHEMISTRY

BCH - 470 : Biochemical Endocrinology and Tissue culture (2008 Pattern)

Biochemical Endocrinology and Plant Biochemistry (2010 Pattern)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Draw neat-labelled diagram wherever necessary.***
3) ***Figures to the right hand side indicate full marks.***
4) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Biochemical Endocrinology

Q1) Answer any three of the following : **[15]**

a) Describe the steps involved in synthesis and release of thyroid hormones.

b) What are releasing hormones? What are release-inhibiting hormones? What secreter them? What gland do they act on?

c) Name the hormones produced by the adrenal medulla. Describe how these hormones affect the body. What causes these hormones to be produced?

d) Describe the mechanism to control the secretion of glucagon.

Q2) Attempt any three of the following : **[15]**

a) Discuss the mechanism of steroid hormones in regulation of gene expression.

b) What are prostaglandins? Write note on their functions.

c) Write a note on gastrointestinal hormones.

d) What does the term mellitus “hyperglycenia”, “glucosuria”, “polyuria” and “polydipsia” refer to.

P.T.O.

Q3) Answer any two of the following : **[10]**

a) Explain the mode of action of CAMP as secondary messenger.

b) Write a note on enkephalin.

c) Discuss how the negative-feedback mechanism helps to maintain proper balances of hormones in the blood.

SECTION - II

Tissue Culture (Old)

Q4) Answer any three of the following : **[15]**

a) What is media? Give the importance of micronutrient.

b) Describe the various ways of sterilization.

c) Give the process and importance of Agrobacterium mediated hairy root culture.

d) Define phytochemical. Give their importance.

e) Explain the process of hardening in plant tissue culture.

Q5) Answer any three of the following : **[15]**

a) What is natural media? Give the example of natural media and mention its advantage.

b) Give the difference between suspension and monolayer culture.

c) Explain the various types of organ culture.

d) What is secondary culture? How it is obtained?

e) Describe the characteristics of established cell line.

Q6) Write short notes on : (any two) **[10]**

a) Protoplast fusion.

b) Cell banking.

c) Embryo culture.

d) Contact inhibition.

SECTION - II

Plant Biochemistry (New)

Q4) Attempt any three of the following : **[15]**

a) Hill reaction.

b) Photophosphorylation.

c) CO_2 fixation.

d) Biosynthesis of sucrose.

e) Role of sulfur in plant growth.

Q5) Explain any three of the following : **[15]**

a) Function of indole acetic acid.

b) Role of calcium in plant growth.

c) Protoplast fusion technique.

d) Plant tissue culture medium.

e) Seed Germination and storage proteins.

Q6) Write short notes on : (any two) **[10]**

a) Nitrate reductase.

b) Circardian rhythm.

c) Regeneration of plant from callus.

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Total No. of Questions : 6]

SEAT No. :

P1349

[Total No. of Pages : 2

[4226] - 402

M.Sc.

BIOCHEMISTRY

BCH - 471 : Fermentation and Enzyme Technology and Food Technology

(2008 & 2010 Pattern) (Sem. - IV)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to both the sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***

SECTION - I

Fermentation and Enzyme Technology

Q1) Answer any three of the following : **[15]**

a) What do you understand from batch culture?

b) What are the different methods of preservation of industrially important microorganisms?

c) How will you proceed for isolation of resistant mutants?

d) What is meant by media formulation?

e) How filteration is used in product recovery?

Q2) Explain the following : (any three) **[15]**

a) Fermenter design.

b) Effluent treatment.

c) Media optimization.

d) Batch sterilization.

e) Effect of precursors in fermentation.

Q3) Write notes on any two of the following : **[10]**

a) Difference between batch and continuous culture.

b) Instrumentation and control system in fermentation.

c) Chemical methods of effluent treatment.

P.T.O.

SECTION - II

Food Technology

Q4) Answer any three of the following : **[15]**

a) Discuss the source and significance of single cell protein.

b) Elaborate on principles of food preservations.

c) Discuss the process of starch production.

d) Write note on the enzymes used in fruit juice technology.

Q5) Answer any three of the following : **[15]**

a) Elaborate on the significance of primary feedstock.

b) Discuss the role of enzymes in food analysis with suitable examples.

c) Discuss the ethics involved in usage of genetically modified foods.

d) Enlist the types of toxins and discuss their identification methods.

Q6) Write note on any two of the following : **[10]**

a) Food flavouring agents.

b) Artificial sweetner.

c) Foods of animal and plant origin.

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Total No. of Questions : 4]

SEAT No. :

P1350

[Total No. of Pages : 2

[4226] - 403

M.Sc.

BIOCHEMISTRY

BCH - 472 : Genetic Engineering

(2008 & 2010 Pattern) (Sem. - IV)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right hand side indicate full marks.***

Q1) Answer the following (any two) : **[20]**

a) How will you confirm the developmental stage specific gene expression in *Drosophila* using microarray technique.

b) Discuss how maternal effect genes determine polarity in *Drosophila* embryo by encoding morphogens.

c) What are restriction enzymes? Why they are named as restriction endonucleases? Give the role of any five restriction enzymes along with their restriction sites.

Q2) Answer the following (any two) : **[20]**

a) How many methods are used for introducing DNA into streptomyces? Explain each method in brief.

b) What is protein engineering? Explain in detail the method of gene shuffling for producing hybrid genes with suitable example.

c) Explain detailed procedure for cloning of an insulin gene in *E. coli*.

Q3) Answer the following (any two) : **[20]**

a) How will you characterize the recombinant gene by S1 mapping.

b) What is genomic library? How it is prepared? Give the significance of genomic library.

c) Many times viral vectors are preferred over plasmid vectors. Why? Explain with suitable examples.

P.T.O.

Q4) Write short notes (any four) : **[20]**

a) DDRT PCR.

b) Transgenic animals.

c) Metagenomics.

d) M_{13}.

e) Geneome of bacteriophage λ.

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Total No. of Questions : 6]

SEAT No. : [ ]

P431

[Total No. of Pages : 4

[4227] - 301

M.Sc.

DRUG CHEMISTRY

CH - 361 : Chemistry of Heterocycles and Biologically Active Compounds

(2008 Pattern) (Sem. - III)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Explain any four of the following : **[12]**

a) The 'H NMR spectrum of 2- amino pyrrole in acetic acid shows no coupling between the H-5 and those at H-4 or H-3.

b) Nitration of aniline is difficult in acidic solution but nitration of 2-and 4-aminopyridines can be achieved easily.

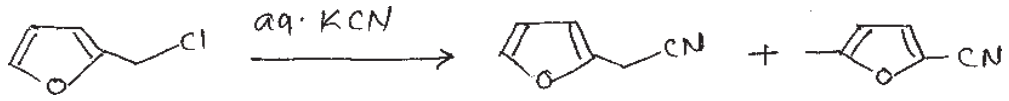
c) Pyrimidine is resistant to electrophilic substitution as compared to imidazole.

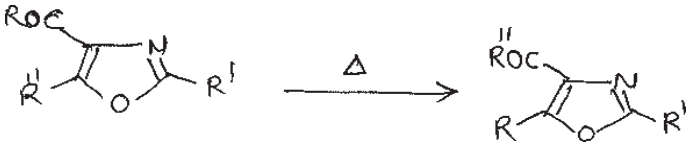
d) Indole shows better selectivity for electrophilic substitution than Benzofuran.

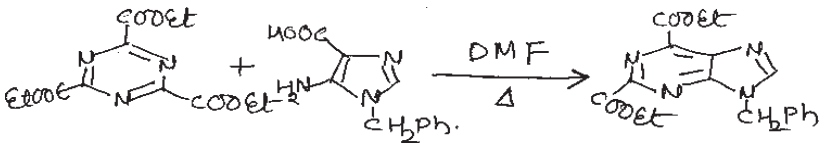
e) The Bischler Napieralski synthesis works best if electron donating groups are present on the ring.

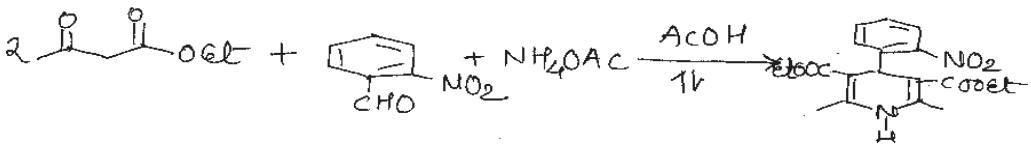
P.T.O.

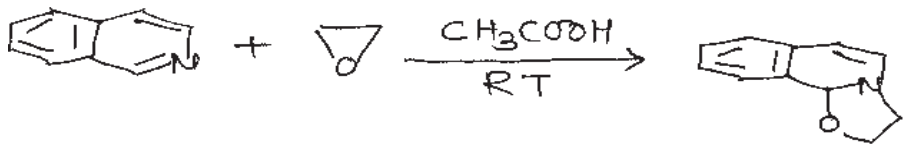
Q2) Suggest the suitable mechanism for <u>any four</u> of the following : **[12]**

a) 

b) 

c) 

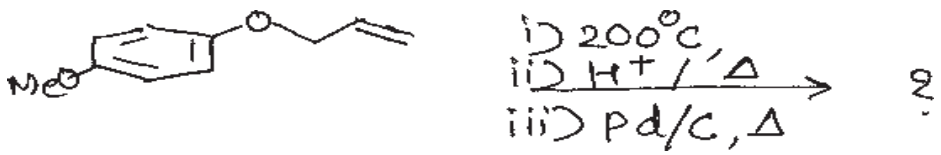
d) 

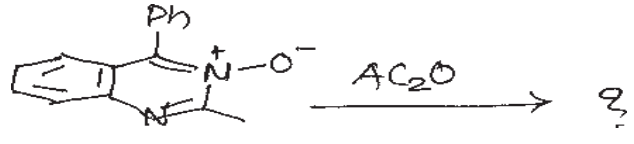
e) 

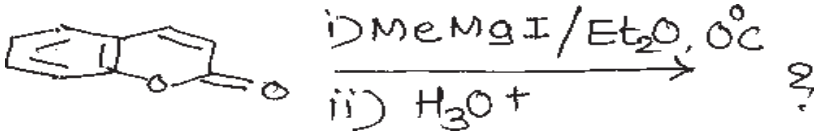
Q3) a) Write short notes on <u>any three</u> of the following : **[9]**

i) Skraup Quinoline Synthesis
ii) Fischer Indole Synthesis
iii) Fiest Benary Synthesis
iv) Hinsberg Thiophene Synthesis

b) Predict the products with mechanism (any two) : **[7]**

i) 

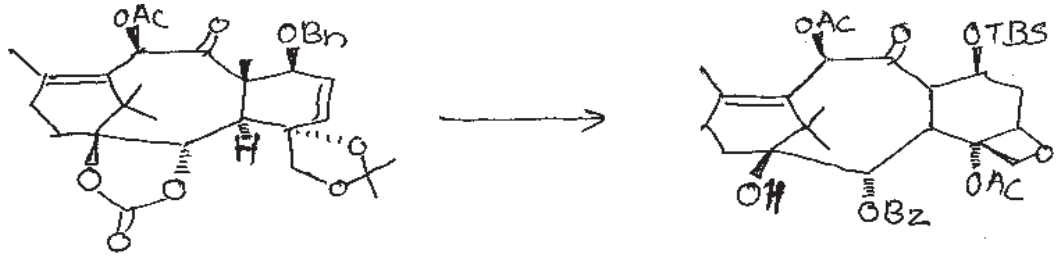
ii) 

iii) 

SECTION - II

Q4) Discuss the steps involved in the synthesis of following naturally occurring drug molecules or intermediates. Explain the mechanism (any three). **[15]**

a)



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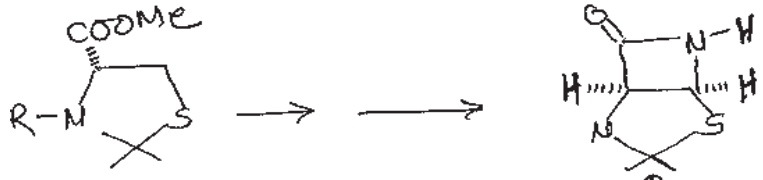

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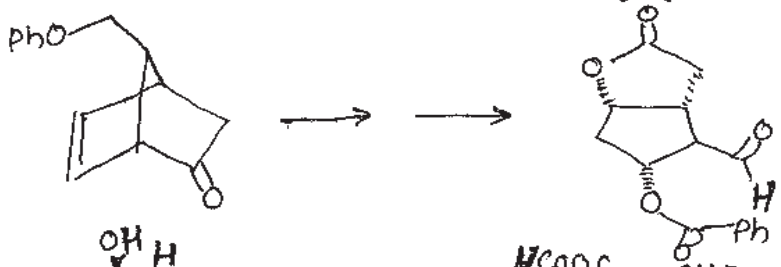

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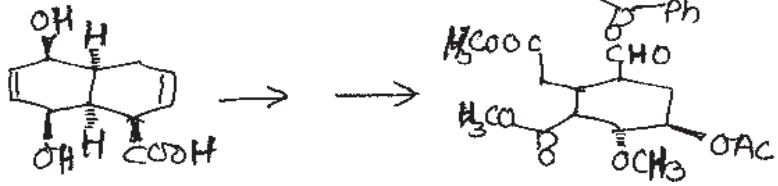
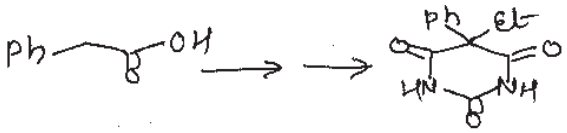
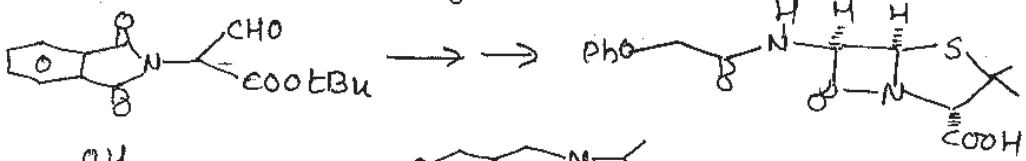


Q5) Discuss the steps involved in the synthesis of the following drug molecules from the precursors shown (any four). **[16]**

a)



b)



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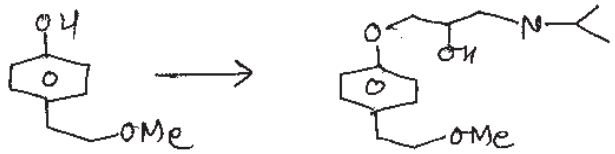

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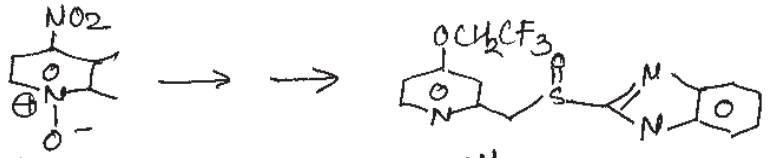
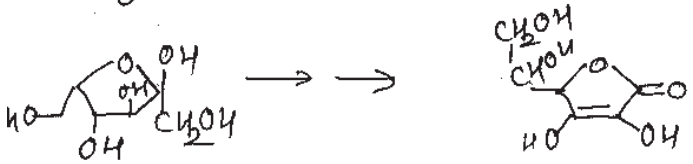
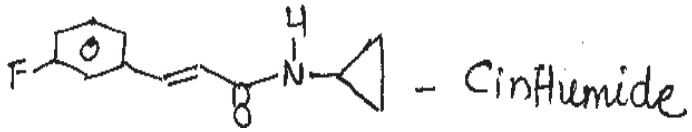


e)

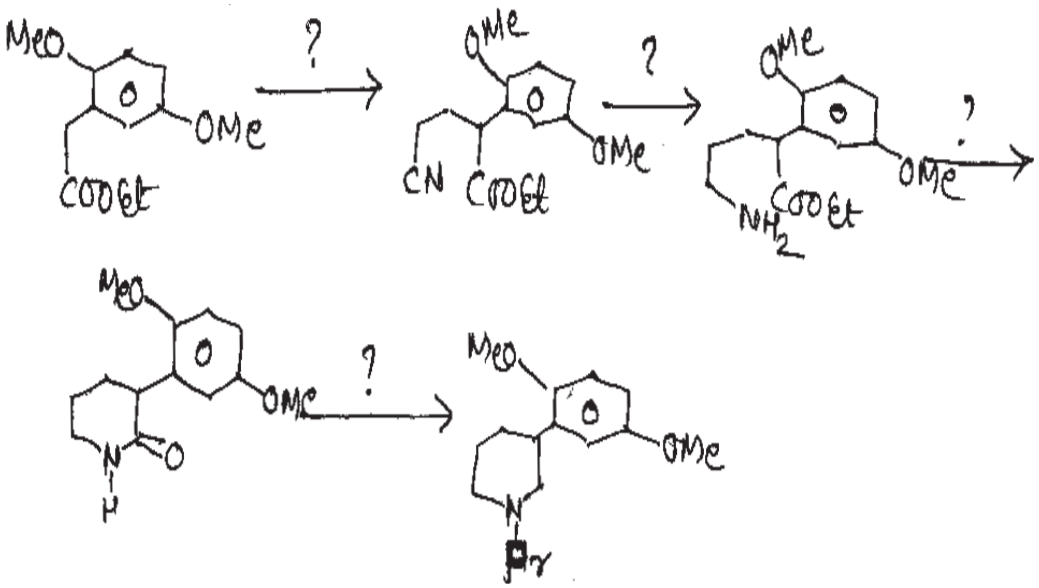


Q6) Answer <u>any three</u> of the following : **[9]**

a) Do a reterosynthetic analysis of cinflumide. Give a synthetic pathway for its synthesis starting with



b) Identify the missing reagents and explain the following transformation.



c) Write a note on shapiro reaction.

d) Discuss in brief olefin metathesis reaction and its applications.

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Total No. of Questions : 6]

SEAT No. : ____

P432

[Total No. of Pages : 4

[4227] - 302

M.Sc.

DRUG CHEMISTRY

CH - 362 : Advanced Analytical Methods

(2008 Pattern) (Sem. - III)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures to the right side indicate full marks.***

SECTION - I

Q1) Answer any four of the following : **[12]**

a) Ethylacetoacetate shows nine signals in its CMR. Explain.

b) Differentiate the following by mass spectrometry

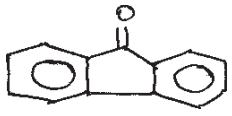
c) Explain the importance of isotope peaks in MS for structure elucidation.

d) In $CF_2 = CH_2$, the two protons are chemically equivalent but magnetically non-equivalent. Explain.

e) CH_2DCl shows a triplet of 1 : 1 : 1 intensity in CMR. Explain.

Q2) Answer any four of the following : **[16]**

a) A compound with mol. formula $C_{16}H_{14}O_4$ has partial structure, complete the structure by placing the substituents at proper positions using the following data.



6.6(d, 2.5 Hz, 1H) 6.91 (d,2.5Hz,1H)
7.09 (dd, 9 & 2Hz, 1H) 7.16 (t, 9Hz, 1H)
7.3 (dd, 9 & 2Hz, 1H)

b) Deduce the structure

M.F. : $C_6 H_{10} O_2$

PMR : 1.3 (t, 7Hz, 3H) 1.9 (dd, 6.5 & 0.5 Hz, 3H)
4.1 (q, 7Hz, 2H) 5.8 (dd, 16 & 0.5 Hz, 1H)
6.9 (dq, 16 & 6.5 Hz, 1H)

CMR : 15 (q) 19(q) 61(t) 122 (d) 144 (d) 168 (s)

P.T.O.

c) Deduce the structure

M.F. : $C_{10} H_{10} O_3$

IR : 1680, 1602 cm^{-1}

PMR : 3.1 (t, 6Hz, 2H) 3.9 (s,3H), 4.5(t, 6Hz, 2H)
6.75(d, 2Hz, 1H) 6.9(dd, 2 & 8 Hz, 1H)
8.05 (d, 8Hz, 1H)

d) Elucidate the structure

M.F. : $C_8 H_4 O_3$

CMR : 125.3 (40) 131.1 (20) 136.1 (40) 163.1 (20)

DEPT 1 : 125.3, 136.1 up
131.1, 163.1 absent

DEPT 2 : 125.3, 136.1 up

e) Deduce the structure

M.F. : $C_{12} H_{14} O$

IR : 2240 cm^{-1}

Mass : 174, 156, 141, 102, 43

CMR : 132 (d, str.) 128.5 (d,str.) 128 (d) 122(s,w)
92(s, w) 82(s, w) 68(s, w) 36(t) 28(q) 8(q)

Q3) Write short notes on <u>any three</u> of the following : **[12]**

a) HETCOR

b) Double focussing mass spectrometer

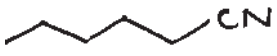
c) AMX Spin system in PMR

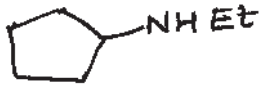
d) Use of Karplus equation in determination of vicinal coupling constant.

SECTION - II

Q4) a) Explain the genesis of the ions (any three) : **[9]**

i)  73, 72, 58, 44, 30

ii)  97, 96, 54, 41, 27

iii)  85, 84, 70, 56

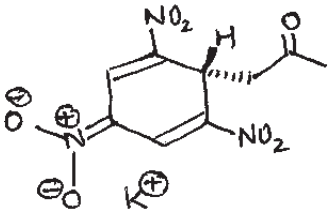
iv)  58, 57, 43, 42, 41

b) Two isomers of $C_6 H_{14}$ show following mass spectral data. Assign structures to each isomer. **[3]**

X : 86(15.5) 57(100) 43(81) 42(41) 41(70) 29(61)

Y : 86(0.1) 57(98) 56(32) 43(100) 41(56) 29(48)

Q5) a) Assign the given ^{13}C-NMR signals to various carbons in the given compounds. **[4]**

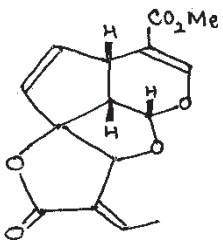


205.6 (s, w) 133.4 (s)

127.6 (d, str.) 121.6 (s, w)

47.0 (t) 34.5(d) 29.8(q)

b) Assign the given 'H NMR signals to various protons in the given compound and comment on the double resonance experiments given below : **[4]**



2.11 (d, 7Hz, 3H) 3.46(dd, 6 & 9 Hz, 1H)

3.79(s, 3H) 4.0(dt, 9 & 2.5Hz, 1H)

5.59(d, 6Hz, 1H) 5.67(d, 6Hz, 1H)

6.08(dd, 6 & 2.5Hz, 1H) 5.1(bs, 1H)

7.19(dq, 7 & 1.5Hz, 1H) 7.46(s, 1H)

Spin decoupling Expt:

i) Irradiation at 3.46δ changes 5.59 (d) → (s)
changes 4.0 (dt) → (t) (2.5Hz)

ii) Irradiation at 7.19δ changes 2.11 (d) → (s)
changes 5.1 (bs) → sharp singlet

c) Answer <u>any two</u> of the following : **[8]**

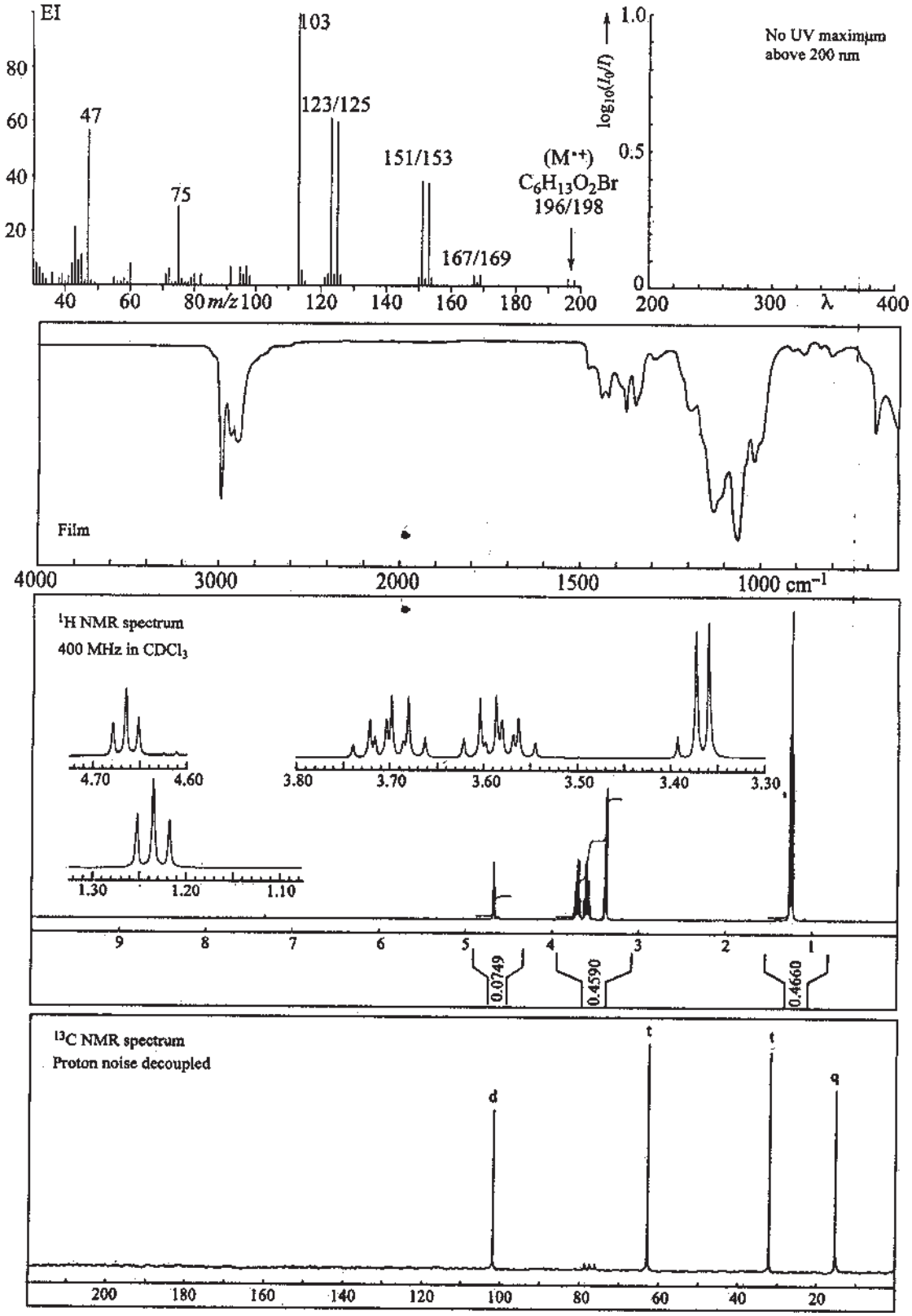
i) Short note on factors affecting the resolution in HPLC.

ii) What are the various detectors used in GC and HPLC. Give the selection criterion for a particular detector.

iii) Explain how correlated spectroscopy help in assigning the chemical shifts of protons in a molecule with proper example.

Q6) Deduce the structure of an unknown compound whose spectral data is provided given below Justify your answer. **[12]**

C, 36.5%; H, 10.0%



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Total No. of Questions : 6]

SEAT No. : ____

P433

[Total No. of Pages : 2

[4227] - 303

M.Sc.

DRUG CHEMISTRY

CH - 363 : Drug Development

(2008 Pattern) (Sem. - III)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory***
2) ***Figures to the right indicate maximum marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Answer any three of the following : **[15]**

a) Explain sceening protocols for isolation of micro-organisms producing antifungal compounds.

b) Describe media components used for industrial fermentation process.

c) Give a flow sheet of a typical industrial fermentation process.

d) What are steps in purification of antibiotic from fermentation broth.

e) Explain aerobic processes for treatment of industrial effluent.

Q2) Attempt any three of the following : **[15]**

a) Explain different classes of adaptive immunity with suitable examples.

b) With the help of diagram, explain structure of IgM molecule.

c) Give classification of hypersensitivity. Explain type I hypersensitivity in detail.

d) What are vaccines? How vaccines are manufactured?

e) Describe precipitation technique for detection of antigen-antibody interaction.

Q3) Answer any two of the following : **[10]**

a) Give a brief account of drug targets and explain how some of the drugs exhibit their activity by acting on these targets?

b) Give a brief commentary on various sources of drugs. Discuss how the active ingredients are isolated from plant sources.

P.T.O.

c) Explain the following terms.

i) Blood brain barrier ii) Antagonist

iii) Drug clearance iv) Efficacy

v) MIC

SECTION - II

Q4) Answer any three of the following : **[18]**

a) How is the dosage form of a drug decided? Discuss the benefits & short comings of any four dosage forms.

b) Give a brief account of strategies employed in lead development with proper examples.

c) Explain in brief the process of drug absorption. What are the major pathways of drug absorption? What are the strategies adopted to increase the drug absorption & bioavailability?

d) Explain bioassay & discuss the characteristics of an ideal bioassay. Describe in brief how invivo & invitro tests are conducted with examples.

Q5) Answer any two of the following : **[14]**

a) What are patents? What is the process of grant of a patent? Explain the contents of provisional specification of complete specifications.

b) Discuss in brief the observations done in phase II of clinical trials. What is the need for placebo controlled double blind studies? How does phase III differ from phase II?

c) Discuss in brief the various toxicological tests performed on an NCE before given permission for clinical trials? Explain their significance in brief.

Q6) Answer any two of the following : **[8]**

a) Strategies employed for economisation of an industrial process.

b) Role of QA & safety in pharma industry.

c) Phase I & Phase II metabolism.

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Total No. of Questions : 6]

SEAT No. :

P435

[Total No. of Pages : 3

[4227] - 401

M.Sc.

DRUG CHEMISTRY

CH-461 : Synthetic Methods in Organic Chemistry

(2008 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Explain any three of the following : **[9]**

i) 1, 4 - dicarbonyl compounds can be prepared by reagents having umpolung reactivity.

ii) Amino group protection is done using Urethane protection in peptide synthesis.

iii) For boron rearrangements the migration preference is n-alkyl > s-alkyl > t-alkyl.

iv) α, β- unsaturated carbonyl compound react with sulphonium ylide and sulphoxonium ylide in different manner.

b) Complete the following transformation & justify your answer (Any two) **[6]**

i) 

ii) 

iii) 

P.T.O.

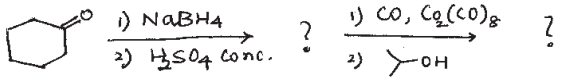
Q2) a) Explain the role of the catalyst in <u>any two</u> of the following : **[6]**

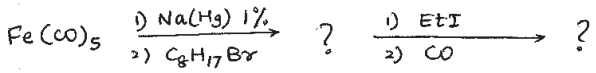
i) Nucleophilic attack on an isolated double bond using pd cl_2.

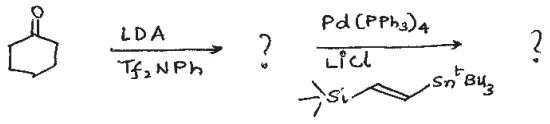
ii) Olefin metathesis using Grubb's catalyst.

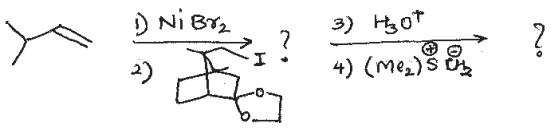
iii) Oligomerization reaction of 1, 3 - butadiene using Nickel tetra carbonyl.

b) Predict the product in <u>any three</u> of the following : **[9]**

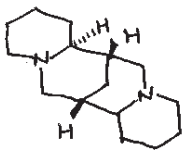
i) 

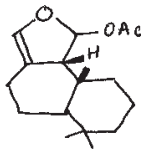
ii) 

iii) 

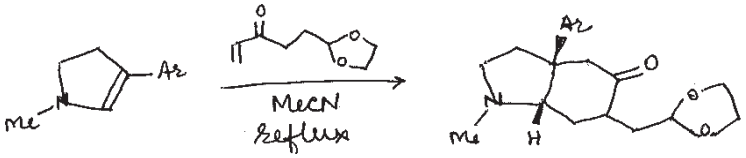
iv) 

Q3) a) Explain the biomimetic approach to reterosynthesis Explain how this method is used to obtain <u>any one</u> of the following : **[5]**

i) 

ii) 

b) Explain how Domino reaction is preferred over multi step synthesis. Explain the following Domino reaction. **[5]**



SECTION - II

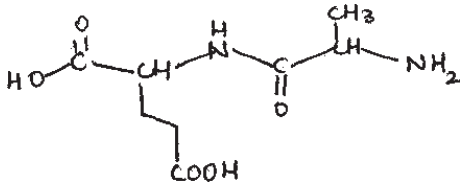
Q4) a) Give brief account of <u>any one</u> of the following : **[4]**

i) Ionic liquids in organic synthesis.

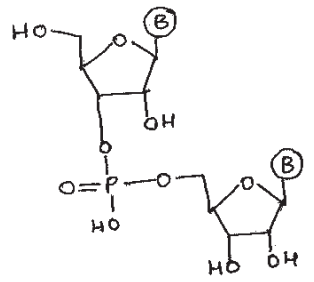
ii) Hydroxyl group protection in poly nucleotide synthesis.

b) Answer <u>any four</u> of the following : **[12]**

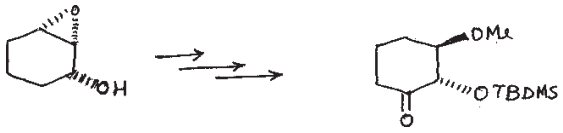
i) Discuss the steps involved in the synthesis of the following dipeptide.



ii) Explain the steps involved in the synthesis of dinucleotide.



iii) Carry out the transformation using the reagents given below (Arrange the reagents in proper order).



TBDMS Cl, Py; PCC, NaoAc; NaH, BnBr; H_2/Pd-c

iv) Carry out the following conversion using organo borane chemistry.

v) Using method of Umpolung achieve the following conversion.

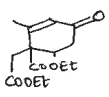
Q5) a) Discuss the synthetic utility of <u>any two</u> of the following : **[6]**

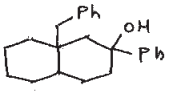
i) $AlEt_3/TiCl_4$ ii) Bu_3SnH iii) DCCI

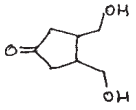
b) Give one reaction with reagent, for each synthon given below. **[6]**

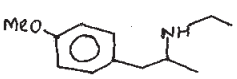
i)  ii) iii) 

Q6) Using retrosynthetic analysis, suggest a suitable method to synthesize <u>any three</u> of the following : **[12]**

a) 

b) 

c) 

d) 

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Total No. of Questions : 6]

SEAT No. : ____

P436

[Total No. of Pages : 2

[4227] - 402

M.Sc.

DRUG CHEMISTRY

CH - 462: Chemotherapy

(2008 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections to be written in separate answer books.***
3) ***Figures to the right indicate full marks.***

SECTION - I

Q1) Answer any three of the following : **[15]**

a) What are antibiotics? How are they classified? Discuss the characteristics expected of an ideal antibiotic. Why most of them are selectively toxic.

b) Discuss in brief protein biosynthesis. Explain the steps where the antibiotics act with suitable examples.

c) What are the common viral infections? Explain how viruses multiply in the host tissue. How does Rimatadine or Amantadine inhibit this process.

d) Give a brief account of discovery of penicillins. Discuss with structural details how semisynthetic penicillins have become more popular.

Q2) Answer any two of the following : **[16]**

a) Describe in brief the discovery and development of nitrogen mustards and Cis-platinum complexes used in anticancer therapy. Explain the benefits of the developed candidates and their mechanism of action.

b) Discuss nerve conduction? How this phenomenon is affected in convulsions? Explain the therapeutic strategies applied to rectify nerve conduction in convulsion with suitable examples.

c) Give an overview of enzyme inhibitors as drugs with specific examples of anticancers, antimalarials and antivirals.

Q3) Discuss in brief any three of the following : **[9]**

a) β-lactamase inhibitors b) Prodrugs

c) Aminoglycosides d) Fungal Infections

P.T.O.

SECTION - II

Q4) Answer any three of the following : **[18]**

a) Give a brief account of the functions of the following endocrine organs (any three)

i) Pitutary Gland ii) Adrenal cortex

iii) Thyroid Glands iv) Hypothalamus

b) Discuss how the following diseases are managed by current drugs (any two) :

i) Hypertension ii) NIDDM

iii) Breast cancer

c) Discuss in brief the following (any two) :

i) Mechanism of cardiac muscle contraction

ii) Renin-Angiotensin Pathway

iii) Na^+/K^+ ATPase

d) How are the following group of drugs capable of rectifying a diseased state. (any three)

i) Corticosteroids ii) NSAID'S

iii) Organic Nitrates iv) Anticoagulants

Q5) Answer any two of the following : **[10]**

a) What are the common GIT disorders? Explain ulcers and the strategies to treat Ulcers.

b) Explain in brief the life cycle of malarial parasite and explain the role of Artemesinin and chloroquin as antimalarials with their mechanism of actions.

c) Discuss the discovery of quinolone antibiotics. Comment on the development of fluoroquinolones and their important place in antibacterial therapy.

Q6) Give the mode of action and uses of following drugs (any four) : **[12]**

a) Doxorubicin b) Meropenem

c) AZT d) Fluconazole

e) Pyrazinamide f) Etoposide

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Total No. of Questions : 6]

SEAT No. :

P437

[Total No. of Pages : 3

[4227] - 403

M.Sc.

DRUG CHEMISTRY

CH-463: Drug Design

(2008 Pattern) (Sem. - IV)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections to be written in separate answer books.***
3) ***Figures to the right indicate maximum marks.***

SECTION - I

Q1) Answer any two of the following : **[12]**

a) What is correlation, mention different types. Compute Karl - Pearsons's Coefficient of correlation between Income and Expenditure in thousands Rs. for 8 Families.

Income (X) :	8	10.5	12	15	18	21	22.5	30
Expenditure (Y) :	7.5	10	12	14.5	16	17.5	18	27

b) Define Probability of an event. Two persons A and B solve a particular problem independently have probabilities 0.4 and 0.5 respectively. Find the probability that the problem is solved.

c) What we test in chi-square test of goodness of fit. In an experiment of pea breeding, out of 1600 seeds, 915 were round green, 293 were wrinkled green, 310 were round yellow and remaining were wrinkled yellow. The Mendel's ratio is 9:3:3:1 for this in order. Test whether experiment fits the theory or not [χ^2_3, 5% = 7.815].

Q2) Answer any two of the following : **[14]**

a) Enlist the therapeutic biologicals, manufactured by using recombinant DNA technology. Explain the manufacturing process of any one in detail.

b) Explain any two of the following :

i) Edible vaccines ii) Monoclonal antibodies

iii) Restriction endonucleases

c) Explain use of PCR in disease diagnosis.

P.T.O.

Q3) Answer any two of the following : **[14]**

a) Give a brief overview of solid phase synthesis. How is this technique applied to synthesize combinatorial libraries? Explain its utility in drug discovery.

b) What are the various drug receptor interactions involved for drug activity. Explain the working of voltage-gated and ligand-gated ion channels.

c) What is the need for prodrug design. With examples explain the benefits of prodrugs over routine drugs.

SECTION - II

Q4) Answer any three of the following : **[18]**

a) Discuss the receptor theories of drug action and explain agonist, antagonist, partial agonist and partial antagonist.

b) Write the generic, empirical force field equation and explain the significance of the various terms in energy calculation.

c) What is QSAR? Discuss how Hansch developed a correlation between numerical descriptors of physicochemical properties and biological activity in his correlation analysis.

d) How are the following calculated/ determined experimentally in a QSAR analysis.

i) π ii) σ iii) Es

Q5) Answer any two of the following : **[12]**

a) Explain any two of the molecular mechanics energy minimisation techniques.

i) Steepest Descent.

ii) Conjugate gradients.

iii) Newton Raphson Procedure.

b) Explain in brief structure based drug design when the structure of

i) Receptor is known.

ii) Receptor is unknown.

c) Explain in brief any two of the following :

i) Free Wilson Method.

ii) Topliss Mannual Method.

iii) 3 D QSAR.

Q6) Answer any two of the following : **[10]**

a) How will you approach to design a enzyme inhibitor based on understanding of the binding pockets and active site.

b) What are the statistical tests used for the validity of a QSAR equation. Explain all of them.

c) Discuss the following. (any two)

i) Computers in drug design.

ii) 3 D pharmacophore.

iii) Ab-initio methods.

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Total No. of Questions : 4] **SEAT No. :**

P404 **[Total No. of Pages : 3**

[4225] - 305
M.Sc.
PHYSICAL CHEMISTRY
CH 315 : Special Topics in Physical Chemistry
(2008 Pattern) (Sem. - III)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***Answers to the TWO sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic table, calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physical - Chemical Constants

1	Avogadro Number	N	=	6.022×10^{23} mol^{-1}
2	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} molecule^{-1}
			=	1.38×10^{-23} J K^{-1} molecule^{-1}
3	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	80314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7	Faraday Constant	F	=	96487 C equiv^{-1}
8	Speed of light	c	=	2.997×10^{10} cms^{-1}
			=	2.997×10^{8} m s^{-1}
9	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10	1 amu		=	1.673×10^{-27} kg
11	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Write the charge balance for H_3PO_4 and Na_2Se.

b) What is the proton condition for $Na_2S_2O_3$ and H_2CO_3 ?

c) Draw a logarithmic concentration diagram for 0.1M acetic acid. (Given:pka = 4.75).

d) Find the concentration of CO_3^{2-}, HCO_3^- and H_2CO_3. The pH of 1×10^{-2}M solution of salt of carbonic acid is 6.3. (Given : $ka_1 = 4.46 \times 10^{-7}$, $ka_2 = 5.62 \times 10^{-11}$).

e) Give the classification of sensors on the basis of their purpose and the materials used.

f) Write a note on chemiresistors.

Q2) Attempt any four of the following : **[20]**

a) Why are ceramics used in sensor? State the characteristics of conducting electrodes used in sensors.

b) Explain the adsorption isotherm of type I and type IV.

c) Discuss the catalysis in dilute aqueous solution.

d) Derive the expression for saturation kinetics of an enzyme-catalyzed reaction.

e) Define the terms catalyst, poison and selectivity.

f) Discuss the mechanism of general acid-base catalysis.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Derive the phase rule equation.

b) Draw a neat labelled diagram of atomic force microscope and explain its working.

c) Discuss different types of actuators, giving examples.

d) Discuss the characteristics of smart materials.

e) Write a note on sushi sensor.

f) Explain what are intelligent gels.

Q4) Attempt <u>any four</u> of the following : **[20]**

a) Explain the working of the Pachinko machine.

b) Discuss the chemical methods of preparing nanoparticles.

c) How are nanoparticles hazardous to humans ?

d) Explain how the electron microscope is used in different analytical techniques.

e) Discuss the application of phase rule to the sulphur system.

f) Explain the functioning of smart windows and smart glasses.

■■■

Total No. of Questions : 4]

P404 **[Total No. of Pages : 3**

[4225] - 305

M.Sc.

PHYSICAL CHEMISTRY

CH 316 : Environmental Pollution

(2004 Pattern) (Sem. - III)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***Answers to the TWO sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic table, calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

1	Avogadro Number	N	=	6.022×10^{23} mol^{-1}
2	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} molecule^{-1}
			=	1.38×10^{-23} J K^{-1} molecule^{-1}
3	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7	Faraday Constant	F	=	96487 C equiv^{-1}
8	Speed of light	c	=	2.997×10^{10} cms^{-1}
			=	2.997×10^{8} m s^{-1}
9	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10	1 amu		=	1.673×10^{-27} kg
11	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Attempt <u>any four</u> of the following : **[20]**

a) What are different types of deposition Processes of air Pollutants? Explain any one deposition process.

b) Describe in brief with a neat diagram the nitrogen cycle.

c) What is biochemical effect? Explain the effect of NO_X on human health.

d) Discuss with the help of labelled diagram hydrological cycle.

e) What are the health effects of air pollutants ?

f) Write a note on : atmospheric photochemistry.

Q2) Attempt <u>any four</u> of the following : **[20]**

a) Explain the effects of acid rain in detail and discuss rain water composition.

b) Write a note on : biological cycle.

c) Discuss the chemical examination of water with reference to phosphate and sulphate.

d) Discuss briefly modified detergents.

e) What are Pollutants? Explain the path ways of pollutants with suitable examples.

f) What are surfactant? Discuss any one in brief.

SECTION - II

Q3) Attempt <u>any four</u> of the following : **[20]**

a) 'Ozone layer is a protective shield' explain.

b) Write a note on : The Los-Angeles Smog.

c) Discuss the thermal pollution with reference to biotic damage.

d) Discuss in detail : the ecological impact of organochlorine compounds.

e) What is the effect of fertilizers on soil Pollution.

f) Write a short note on : Polymer degradation.

Q4) Attempt <u>any four</u> of the following : **[20]**

a) Explain the following impurities in water

   i) Fluorides

   ii) Arsenic with respective sources and chemical composition of these.

b) Write a note on : 'Gree house effect'.

c) What is noise pollution ? Discuss the effect of it on human health.

d) What is meant by hardness of water? How is it estimated?

e) Explain the method by which total solids in water estimated.

f) Explain the enzyme inhibition by toxic metals in human beings with suitable examples.

■■■

Total No. of Questions : 6]

SEAT No. :

P410

[Total No. of Pages : 8

[4225] - 311

M.Sc. - II

ORGANIC CHEMISTRY

CH- 351 : Spectroscopic Methods in Structure Determination

(2008 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) a) Answer any four of the following : **[8]**

i) The mass spectrum of 3 - buty n - 2 - 01 shows base peak at $\frac{m}{z} = 55$. Explain why the fragment giving rise to this peak would be very stable.

ii) How will you distinguish the following isomeric esters by ^{1}HNMR ? Ph CH_2O $COCH_3$ and Ph CH_2COOCH_3.

iii) Test-butyl fluoride in ^{13}CNMR shows a doublet at 1.5 δ with J = 20Hz, while on adding SbF_5 it shows only a singlet at 4.6 δ. Explain.

iv) CIMS is used for compounds which show negligible M^+ in the EIMS. Explain.

v) Intensities of methyl, methylene and methine carbons differ in ^{13}CNMR. Explain.

b) Two isomers A and B with molecular formula $C_5H_8O_2$ show IR at 1780 cm^{-1} ^{1}H NMR of A shows two singlets at 1.1 and 2.2 δ with peak area 3:1; while B shows two singlets at 1.2 and 4.0 δ with peak area 3:1. Propose the structures for A and B. Justify. **[4]**

P.T.O.

Q2) Answer any four of the following : **[16]**

a) Deduce the structure from the following data.

Mol. Formula : $C_7H_{14}O_2$.

IR : 1111Cm^{-1}

Mass : 130, 85, 57,

^{13}CNMR : 15 (q)str, 60 (t) str; 101 (d), 118 (t), 135 (d)

PMR : 1.1 (t, J = 7 Hz, 6H), 3.5 (q, J = 7Hz, 4H), 4.75(d, J = 6 Hz, 1H), 5.1(dd,J = 10& 1.5Hz, 1 H), 5.3(ddJ = 16& 1.5 Hz, 1H), 5.8(ddd, J = 16, 10 & 6Hz, 1H).

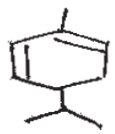
b) Deduce the structure from the following data

Mol. Formula : $C_5H_{10}O_2$

PMR: 4.1 (S, 4H) 1.5(S, 6H).

^{13}C NMR: 25 (q) str, 68 (t) str, 95 (s).

c) Deduce the structure of Ⓐ from the following.



① m-CPBA, CH_2Cl_2/ H_2O, Na_2CO_3.

② LDA, ether.

Ⓐ

Mass : 152 (m^+), 92 (100%), 91 (93%).

IR : 3370, 1640, 1600, 885 cm^{-1}.

PMR : 0.93 (d, J = 6.5 Hz, 6H)

1.4 – 2.1 (m, 4 H, after D_2Oex. 3H)

2.33 (m, 1H)

4.42 (m, 1H)

4.95 (bs, 1H)

5.05 (bs, 1H)

5.85 (d, J = 10Hz, 1H)

6.13 (dd, J = 10 & 3 Hz, 1 H)

d) A Pale yellow liquid with molecular formula $C_{10}H_{12}O_2$ has the following spectral data. Deduce structure from the same.

IR : 3570, 1600, 1500, 1400, cm^{-1}.

^1H NMR : 3.22 (2H, d, J = 7 Hz) 3.8 (3 H, S),
5.00 (2H,m) , 5.26 (1H,ex),
5.95 (1H,m), 6.62 (2H,m),
6.82 (1H,dd, J = 9 & 3Hz).

^{13}CNMR : 39.82, 55.73, 110.97,
114.14, 115.31, 120.95, 131.67,
137·62, 143.64, 146.23.

DEPT :				
	39.82	down	131.67	absent
	110.97	down	143.64	absent
	55.73	up	146.23	absent
	114.14	up		
	115.31	up		
	120.95	up		
	137.62	up		

e) Deduce the structure from the following data.

Mol. Formula : $C_5H_9NO_4$

IR : 1642cm^{-1}

Mass : 147, 102, 84.

^1H NMR : 2.3 (m, 2H), 2.7 (m,2H),
4.1 (t, J = 7Hz, 1H), 4 H ex ;

^{13}CNMR & DEPT : 25 (down), 30 (down), 55(up), 174 (absent), 178 (absent)

Q3) Write notes on <u>any three</u> of the following : **[12]**

a) Factors affecting vicinal coupling constants.

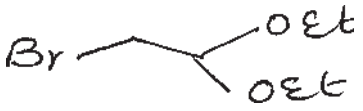
b) Soft ionizalion techniques.

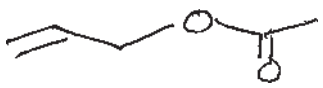
c) Off resonance technique in CMR.

d) Methods for simplification of NMR.

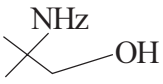
SECTION - II

Q4) a) Explain the genesis of the ions for <u>any four</u> of the following : **[8]**

i)  $\frac{m}{z}$ = 198, 196, 169, 167, 103.

ii)  $\frac{m}{z}$ = 100, 58, 57, 43, 42, 41.

iii) $(H_3C)_2$ –CH O $CH(CH_3)_2$ $\frac{m}{z}$ = 102, 87, 59, 45, 43.

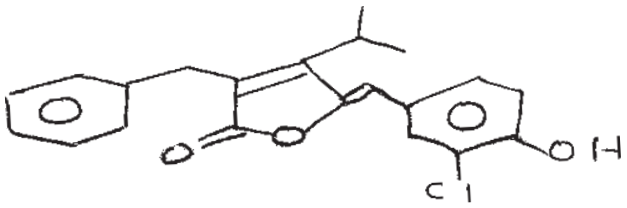
iv)  $\frac{m}{z}$ = 74, 58, 31.

v) Cyclo hexanol $\frac{m}{z}$ = 100, 99, 57.

b) A compound shows following mass fragmentation pattern. Assign the structure to the compound.

$\frac{m}{z}$ = 73(3.9), 72(78), 71(10), 57(30), 44(100), 29(56). **[4]**

Q5) a) The ^{1}H NMR Spectral data of compound X is shown below Assign the signals to the various protons. Use the given decoupling experimental data for the assignments. Justify your assignments. **[8]**



1.31 (d, J = 7.1 Hz 18 mm)

3.14 (septet J = 7.1 Hz, 3 mm)

3.79 (S, 6 mm)

6.09 (S, 3 mm)

7.03 (d, J = 8.5 Hz, 3mm)

7.18 –7.32 (m, 14.8 mm)

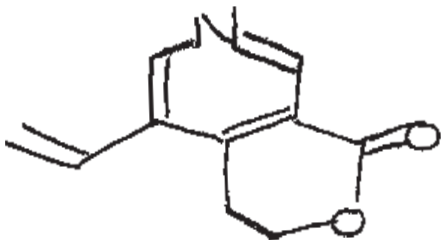
7.61 (dd, J = 8.5 & 2.1 Hz, 3 mm)

7.83 (d, J = 2.1 Hz, 3 mm)

Decoupling experiments

Irradiation at	Change at
3.14	1.31 d → S
7.03	7.61 dd → d J = 2.1 Hz.

b) Assign the chemical shifts to the various carbons **[4]**



24 (t), 66.12 (t), 120.26 (t),

120.82 (s), 129.44 (d),

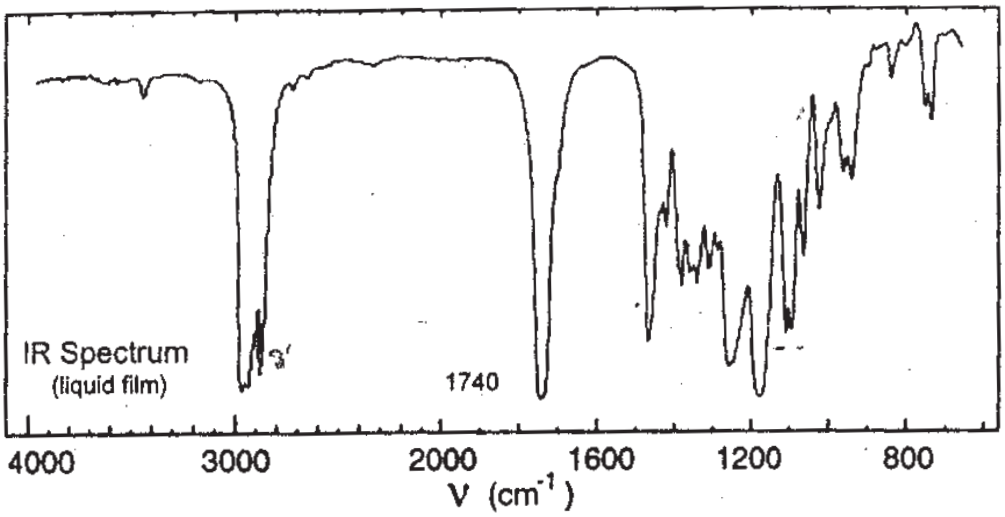
130.72 (s), 144.66 (s),

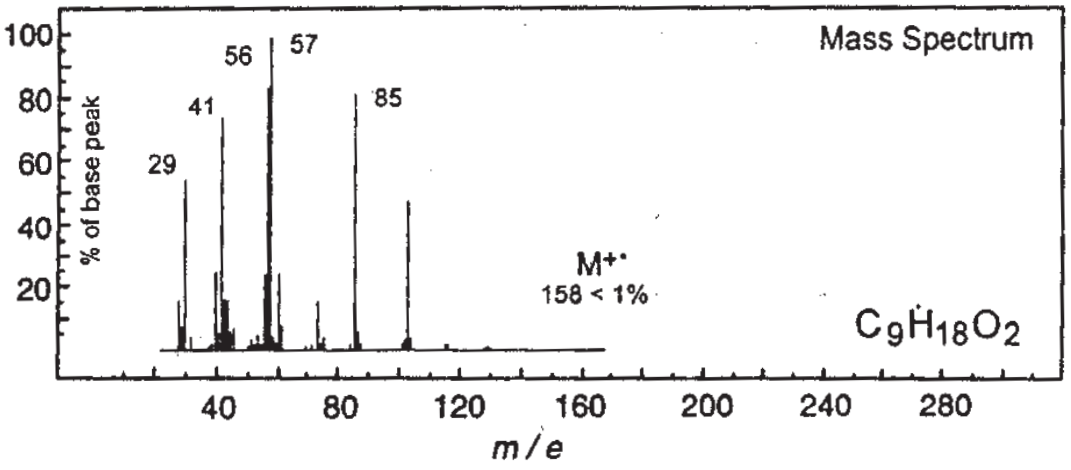
150.20 (d), 150.88 (d),

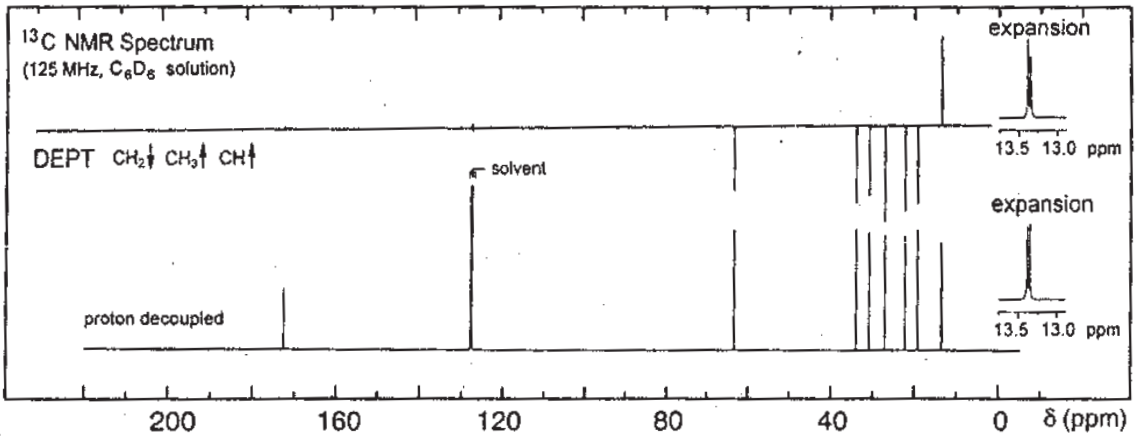
163.46 (s).

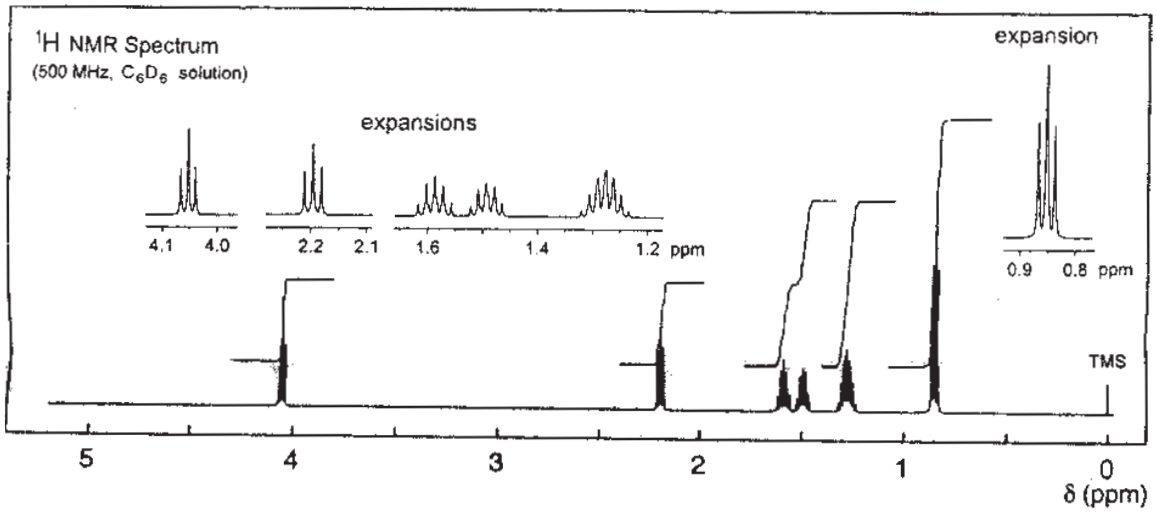
c) Indicate the difference expected in the PMR spectra of the three isomeric trichloro benzenes. **[4]**

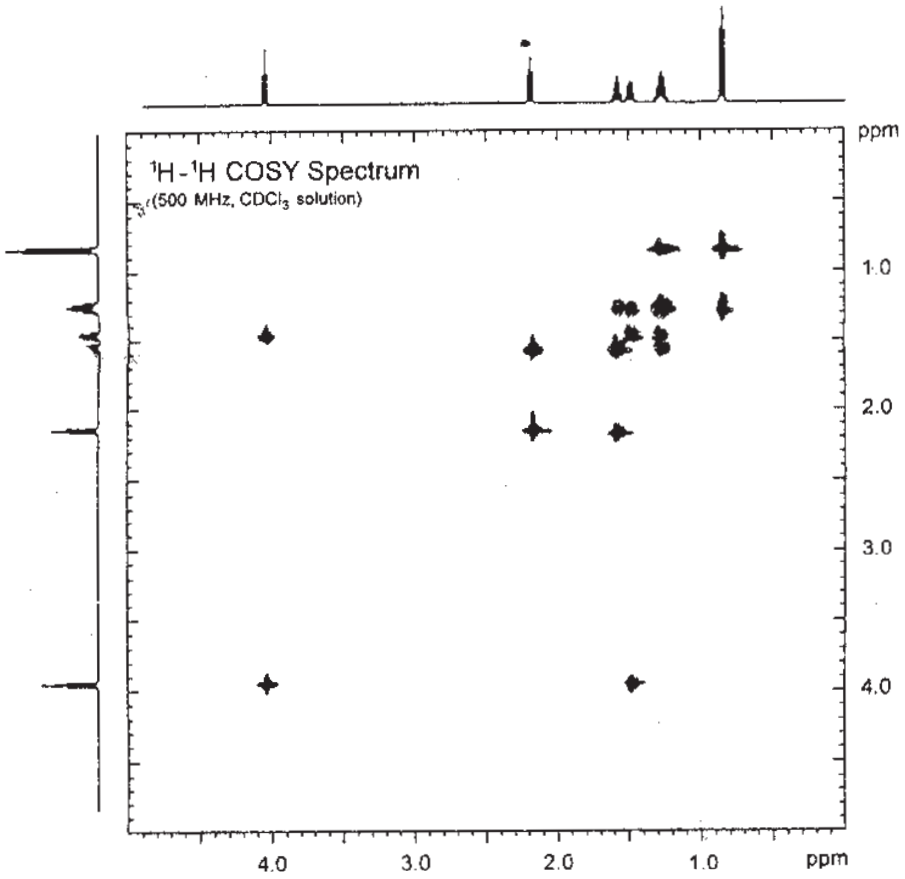
Q6) The spectra of an unknown compound are shown on the adjacent page. Analyse the spectras and use the data to arrive at a structure of the unknown Justify. **[12]**

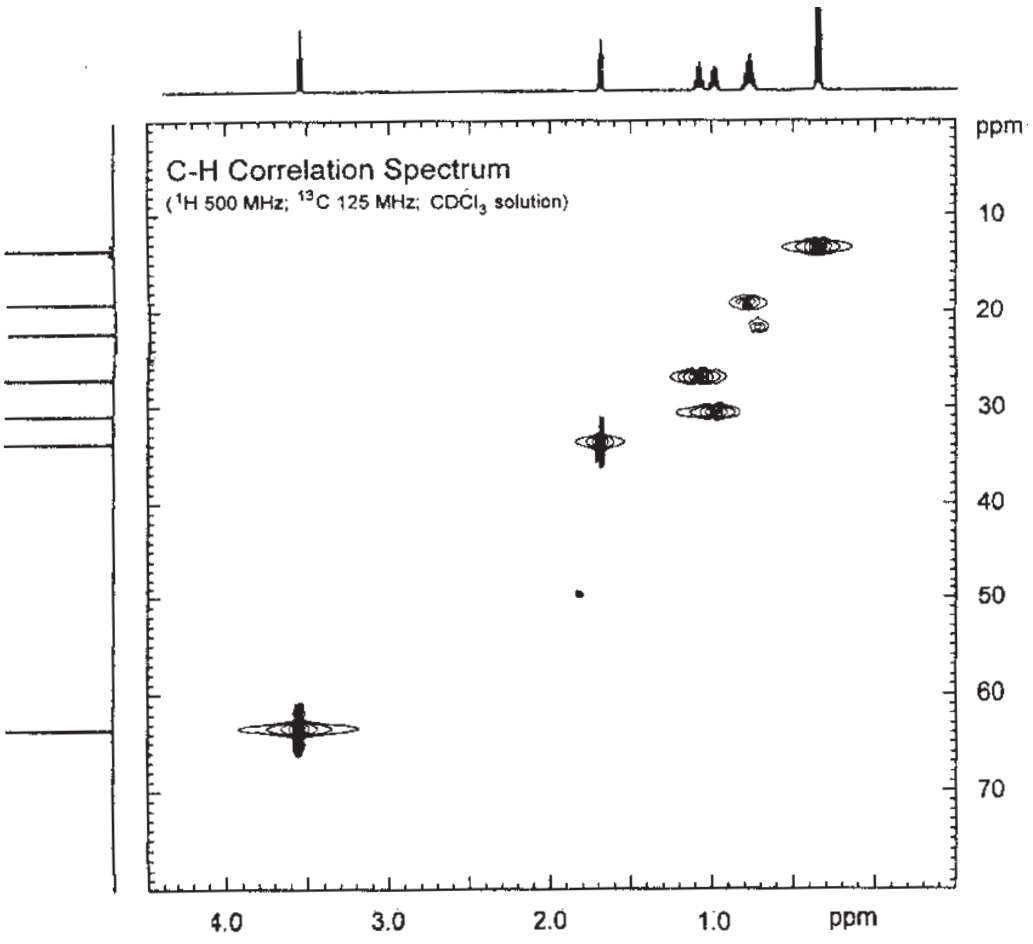







^{1}H NMR Spectrum
(500 MHz, C_6D_6 solution)
expansions
expansion
4.1
4.0
2.2
2.1
1.6
1.4
1.2 ppm
0.9
0.8 ppm
TMS
5
4
3
2
1
0
δ (ppm)


^{1}H-^{1}H COSY Spectrum
(500 MHz, $CDCl_3$ solution)
ppm
1.0
2.0
3.0
4.0
4.0
3.0
2.0
1.0
ppm


C-H Correlation Spectrum
(1H 500 MHz; 13C 125 MHz; CDCl3 solution)
ppm
10
20
30
40
50
60
70
4.0
3.0
2.0
1.0
ppm

■■■

Total No. of Questions : 6]

SEAT No. :

P394

[Total No. of Pages : 4

[4225] - 101
M.Sc.
PHYSICAL CHEMISTRY
CH - 110 : Physical Chemistry - I
(2008 Pattern) (Semester - I)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***Answers to the Two sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic table, calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Explain the experimental evidence of Heisenberg's uncertainty principle.

b) Name three experiments that lead to the failure of classical mechanics. Explain how Planck's distribution law overcame this failure.

c) What are exact and inexact differentials? State Eulers theorem.

d) What is Clausius inequality? How does it lead to the concept of Gibbs and Helmoltz free energy?

e) State the corrolary of the third law of thermodynamics. Explain unattainability of absolute zero temperature.

Q2) Attempt any three of the following : **[15]**

a) What are partial molar quantities? Explain briefly any two methods to determine partial molar volume.

b) Distinguish between clapeyron equation and Clausius - Clapeyron equation. Give their applications.

c) State and explain Raoult's law and Henry's law giving limitations of both.

d) Explain the principle of steam distillation. Give its applications.

e) Derive Vant Hoff isochore. Give its applications.

Q3) Solve any two of the following : **[10]**

a) Calculate the degeneracy of energy level $\frac{86h^2}{8ma^2}$ for a particle in cubic box.

b) Light of wavelength 300 nm is incident on a metal ($\phi = 2.26$ eV). Calculate the velocity of the ejected electrons.

c) By how much will the freezing point of benzene, 5.53°C, be reduced if 10g hexane are added to 100 g benzene?

$[\Delta H_f$ for benzene = 9.836 kJ $mol^{-1}]$

d) Calculate ΔS of the universe and ΔG for the system when 2.00 mol of an ideal gas at 300K occupying a volume of 24.6 L expands isothermally against an opposing pressure of 1.00 atm. to reach equilibrium.

SECTION - II

Q4) Attempt <u>any three</u> of the following : **[15]**

a) Derive the expression for the half-life of an n^{th} order reaction.

b) Consider the reaction mechanism :

$$A + B \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} C \qquad (1)$$

$$C \xrightarrow{k_2} P \qquad (2)$$

write the expression for $\frac{d[p]}{dt}$, the rate of product formation, assuming equilibrium is established in the first reaction before any appreciable amount of product is formed.

c) Derive the expression for the dependence of rate constant on the ionic strength of the reaction medium.

d) For T < 500 K the reaction :

$NO_{2(g)} + CO_{(g)} \xrightarrow{k_{obs}} CO_{2(g)} + NO_{(g)}$ has the rate law

$\frac{d[CO_2]}{dt} = k_{obs}[NO_2]^p$. Show that the following mechanism is consistent with the observed rate law

$2\,NO_{2(g)} \xrightarrow{k_1} NO_{3(g)} + NO_{(g)}$ (rate determining)

$NO_{3(g)} + CO_{(g)} \rightarrow CO_{2(g)} + NO_{2(g)}$

Express k_{obs} in terms of k_1 and k_2.

e) What are fast reactions? Discuss the continuous flow technique to study kinetics of such reactions.

Q5) Attempt <u>any three</u> of the following : **[15]**

a) Discuss the Lindemann's theory of unimolecular reactions.

b) Discuss Fermi-Dirac distribution law and show that $ni = \frac{gi}{\left[e^{\alpha+\beta Ei}+1\right]}$.

c) Derive the expression for total partition function for a molecule.

d) Using potential energy surface, explain the significance of the activation energy of a chemical reaction.

e) Derive the rate law for the formation of hydrogen bromide from H_2 and Br_2.

Q6) Solve <u>any two</u> of the following : **[10]**

a) In the Arrhenius equation for a certain reaction, the values of A and E_a are 4×10^{13} sec^{-1} and 98.6 kJ mol^{-1} respectively. If the reaction is of the first order, at what temperature will its half life be 10 minutes?

b) The gas phase decomposition of dimethyl ether follows first order kinetics

$$CH_3\ COCH_{3(g)} \rightarrow CH_{4(g)} + H_{2(g)} + CO_{(g)}$$

The reaction is carried out in a constant volume container at 500°C. Initially only dimethyl ether is present at a pressure of 0.40 atm. The total pressure of the gaseous reaction mixture after 12 minutes is 0.75 atm. Calculate half life of the reaction.

c) Calculate the relative number of distinguishable states in ice and in water at 273 K.

d) Calculate the translational partition function of a moelcule of oxygen gas at 1 atmosphere and 298 K moving in a vessel of volume 22.4 dm^3. What is the significance of this value of partition function?

☒☒☒☒

Total No. of Questions : 6]

SEAT No. :

P395

[Total No. of Pages : 4

[4225] - 102
M.Sc.
INORGANIC CHEMISTRY
CH - 130 : Inorganic Chemistry - I
(2008 Pattern) (Semester - I) (Part - I)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat and labelled diagrams must be drawn whenever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Sketch and explain the following symmetry elements in $[B_r F_4]^-$ ion and classify it into appropriate point group.

i) Plane of symmetry. ii) Centre of inversion.

b) Using great orthogonality theorem, derive the character table for D_2 point group. Given the classes of D_2 point group are, E, C_2^z, C_2^y, and C_2^x.

c) Develop stereographic projections for the following molecules. Justify your answer.

i) Staggered ferrocene. ii) Cyclopentadienyl anion.

d) By schematic representations, give the products of following symmetry operations in NF_3 molecule.

i) $C_3 \times C_3^{-1}$. ii) $C_3 \times \sigma V_1$. iii) $\sigma V_1 \times \sigma V_2$.

Q2) Attempt any three of the following : **[15]**

a) For a X_eF_4 molecule, find out reducible representation for which sigma bonds form the basis and find out which of the orbitals from the X_e atom will be offered for sigma bonding.
Given : Character table for D_4h point group.

b) Classify any two of the following molecules into appropriate point group. Justify it.

i) CO_3^{2-} (Planar). ii) S_nF_4. iii) SO_2.

P.T.O.

c) Show the matrices for C_2^z and σh^{xy} symmetry operations. Using matrix multiplication method show that $S_2 = i$.

d) Using similarity transformation and group multiplication table given for C_3V point group, divide symmetry operations into appropriate classes. Given : Group multiplication table.

Q3) Answer the following : **[10]**

a) Explain the Weiss and Miller indices. Draw a sketch of (211) and (111) planes in simple cubic system.

b) Multiple choice questions (write correct answer).

i) A square pyramidal MX_5 molecule belongs to C_4v point group. The symmetry operations are E, $2C_4$, C_2, $2\sigma V$, $2\sigma d$. The trace for the reducible representation when symmetry operations of C_{4V} applied to MX_5 is,

a) 51131 b) 11111

c) 51111 d) 41211

ii) The improper axis of rotation is present in

a) Trans H_2O_2 b) SO_2

c) NF_3 d) Pyridine.

iii) The IF_5 molecule belongs to following point group

a) C_4v b) D_5h

c) D_5d d) C_5h

iv) D_4d point group is for the molecule

a) Cyclooctasulphur b) $PtCl_4^{2-}$

c) $MnCl_4^{2-}$ d) CH_4

v) In all Abelian point groups.

a) Number of classes = h (order of the group).

b) Number of classes > h.

c) Number of classes < h.

d) Number of classes = h/2.

1. Character table for D_{4h} point group

D_{4h}	E	$2C_4(z)$	C_2	$2C'_2$	$2C''_2$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$	linears, rotations	quadratic
A_{1g}	1	1	1	1	1	1	1	1	1	1		x^2+y^2, z^2
A_{2g}	1	1	1	–1	–1	1	1	1	–1	–1	R_z	
B_{1g}	1	–1	1	1	–1	1	–1	1	1	–1		x^2-y^2
B_{2g}	1	–1	1	–1	1	1	–1	1	–1	1		xy
E_g	2	0	–2	0	0	2	0	–2	0	0	(R_x, R_y)	(xz, yz)
A_{1u}	1	1	1	1	1	–1	–1	–1	–1	–1		
A_{2u}	1	1	1	–1	–1	–1	–1	–1	1	1	z	
B_{1u}	1	–1	1	1	–1	–1	1	–1	–1	1		
B_{2u}	1	–1	1	–1	1	–1	1	–1	1	–1		
E_u	2	0	–2	0	0	–2	0	2	0	0	(x,y)	

1-Group Multiplication Table for C_{3v}

C_{3v}	E	C_3	C_3^2	σ_v^1	σ_v^2	σ_v^3
E	E	C_3	C_3^2	σ_v^1	σ_v^2	σ_v^3
C_3	C_3	C_3^2	E	σ_v^3	σ_v^1	σ_v^2
C_3^2	C_3^2	E	C_3	σ_v^2	σ_v^3	σ_v^1
σ_v^1	σ_v^1	σ_v^2	σ_v^3	E	C_3	C_3^2
σ_v^2	σ_v^2	σ_v^3	σ_v^1	C_3^2	E	C_3
σ_v^3	σ_v^3	σ_v^1	σ_v^2	C_3	C_3^2	E

SECTION - II

Q4) Answer <u>any three</u> of the following : **[15]**

a) Give classification of binary compounds of hydrogen.
b) Give classification of hydrides of boron.
c) Give an account of compounds of carbon with nitrogen.
d) Explain activation of nitrogen.
e) Give synthesis and structures of xenon fluorides.

Q5) Write notes on <u>any three</u> of the following : **[15]**

a) Solutions of alkali metals in liquid ammonia.
b) Fullerenes.
c) Phosphazenes.

d) Zeolites.

e) Sulphur oxoanions.

Q6) a) Draw <u>any five</u> structures : **[5]**

i) N_2O_5

ii) P_4O_{10}

iii) $[pt\ (pph_3)_2\ (C_{60})]$

iv) $[B_6H_6]^{2-}$

v) IF_7

vi) XeF_2

b) Attempt <u>any five</u> of the following : **[5]**

i) Boron nitride is isostructural with

a) Borazene b) Benzene

c) Graphite d) None

ii) Diamond is used in cutting tools and graphite is used as electrode in cells because -

a) Both are good conductors of heat.

b) Both are good conductors of electricity.

c) Diamond is a good conductor of heat and graphite is a good conductor of electricity.

d) Diamond is a bad conductor of electricity and graphite is a good conductor of electricity.

iii) Correct order of basic character of oxyacids of chlorine is -

a) $ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$

b) $ClO^- > ClO_2^- > ClO_3^- > ClO_4^-$

c) $ClO_2^- > ClO^- > ClO_3^- > ClO_4^-$

d) $ClO_4^- > ClO^- > ClO_2^- > ClO_3^-$

iv) In which of the following compounds, the oxidation state of xenon is not six?

a) X_eOF_2 and X_eO_4 b) X_eF_6 and X_eO_3

c) X_eOF_4 and $X_eO_2F_2$ d) X_eO_3 and X_eOF_4

v) Amongst the hydrides of gr VI elements, which one has the largest bond angle?

a) NH_3 b) PH_3 c) ASH_3 d) SbH_3

vi) Among the following elements, the one that acts as the major component in a semiconductor is -

a) Carbon b) Silicon c) Gallium d) Arsenic

Total No. of Questions : 6]

SEAT No. :

P396

[Total No. of Pages : 4

[4225] - 103

M.Sc. - I

ORGANIC CHEMISTRY

CH - 150 : Organic Reaction Mechanism and Stereo Chemistry

(2008 Pattern) (Semester - I)

Time : 3 Hours] *[Max. Marks : 80*

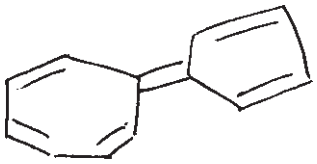
Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Figures to the righ indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Attempt any four of the following : **[16]**

a) Compound A has considerable dipole moment. Explain.

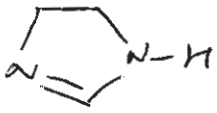


A

b) Explain the pK*a* values of the following compounds.

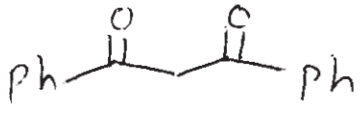
pka 7.1

and



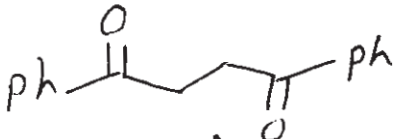
pka 11

c) Compound A exists more in keto form where as B in enol form. Explain.



B

and



A

d) 1-Bromo-1-phenyl ethane reacts with methanol to give a product with 27% inversion, while reaction with sodium methoxide in methanol producess 100% inverted product. Explain.

P.T.O.

e) N, N - Dimethyl aniline reacts much faster in aromatic electrophilic reactions than 2, 6 - N, N - Tetramethyl aniline. Explain.

Q2) Write short notes on <u>any three</u> of the following : **[12]**

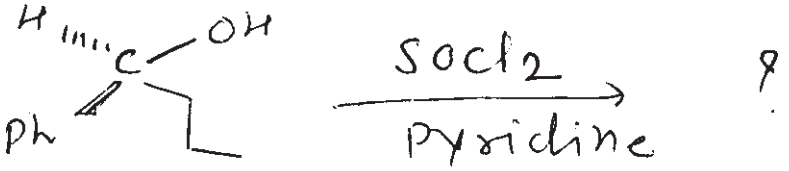
a) Alternant and non alternant hydrocarbons.

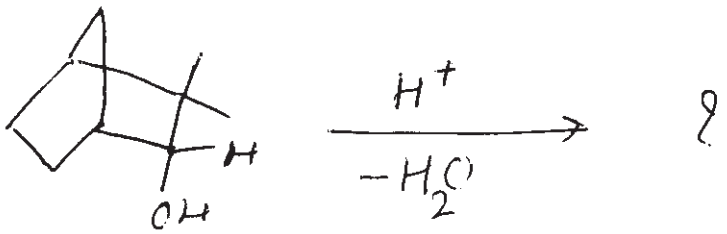
b) IPSO-Substitution.

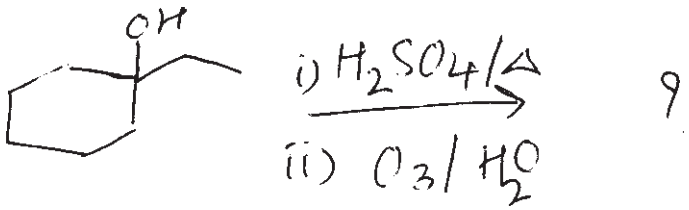
c) Prochiral relationship.

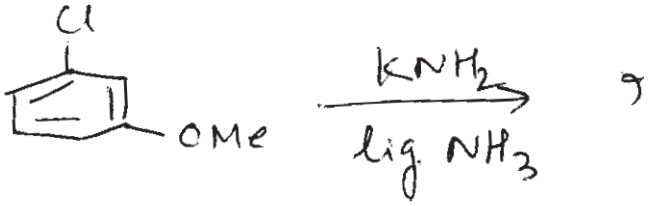
d) Non classical carbocation.

Q3) Predict the products with mechanism (any three) : **[12]**

a) 

b) 

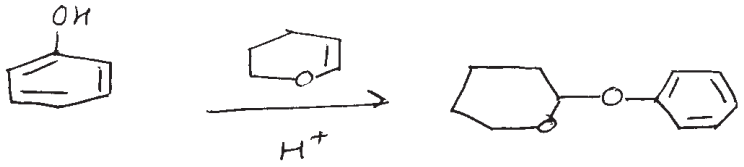
c) 

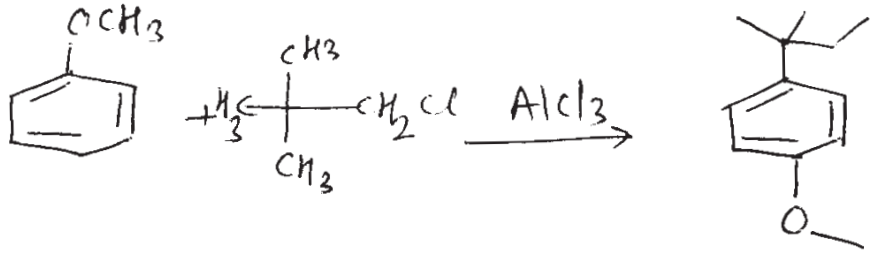
d) 

SECTION - II

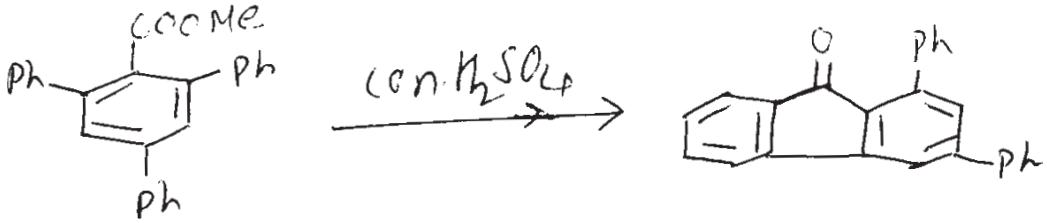
Q4) Suggest mechanism for <u>any four</u> of the following : **[12]**

a) 

b) 

c) 

d) 

e) 

Q5) Attempt <u>any four</u> of the following : **[12]**

a) 1, 2 - Dibromoethane exists in antiform whereas 2-Hydroxy ethanol exists in guache conformation. Explain.

b) Discuss factors affecting strength of bases.

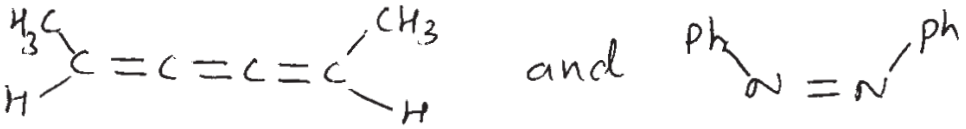
c) Give brief account of hyperconjugation.

d) Electrophilic as well as nucleophilic substitutions of naphthalene occurs at α-position. Explain.

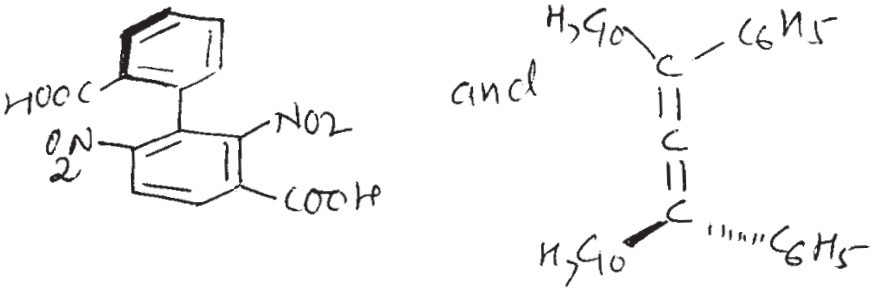
e) Pyrrole exibits acidic character whereas pyridine shows basic character. Explain.

Q6) Attempt <u>any eight</u> of the following : **[16]**

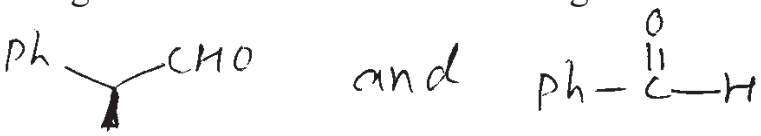
a) Assign E/Z to the following



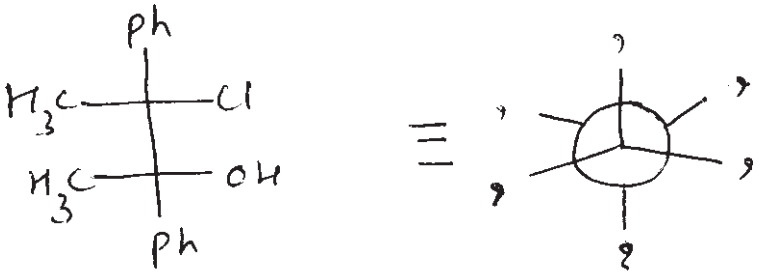
b) Assign R/S to the following



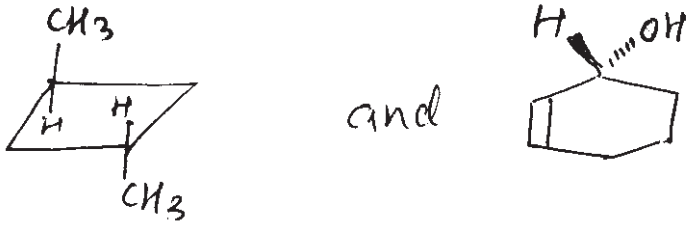
c) Assign Si and Re faces in the following



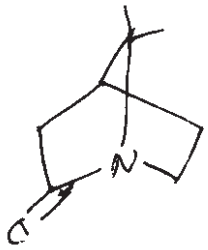
d) Convert Fischer to Newmann for the following structure.



e) Which of the following is optically active? Justify.



f) Generally amides are neutral but following compound exibits basic character. Explain.



g) Draw resonance structures for the following.

h) Cyclopentadiene exibits more acidic character as compared to cycloheptatriene. Explain.

i) Give short account of inclusion compounds.

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Total No. of Questions : 6]

SEAT No. :

P397

[Total No. of Pages : 3

[4225] - 201
M.Sc.
PHYSICAL CHEMISTRY
CH - 210 : Physical Chemistry - II
(2008 Pattern) (Semester - II)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of logarithmic table/calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Explain four applications of FT-IR spectroscopy.

b) Explain the effect of degeneracy on intensity of lines in rotational spectrum.

c) Explain the Raman spectrum of rigid diatomic molecule.

d) Sketch and explain the occurrence of P, Q and R branches of IR spectra of a diatomic molecule.

e) What are normal modes of vibration of polyatomic molecule? Explain fundamental, overtone and combination bands.

Q2) Attempt any three of the following : **[15]**

a) Explain the principle of photoelectron spectroscopy (PES). Explain the photoelectron spectrometer used to measure the kinetic energy of electron in PES.

b) What is dissociation energy? Illustrate dissociation of molecule by excitation into stable upper state.

c) Sketch and explain stick diagram showing the low resolution H^1NMR spectrum of ethyl alcohol.

d) Discuss the quantum theory of Raman effect. Explain the criterion for the molecule to be Raman active.

e) Give the applications of ESR spectra.

Q3) Solve any two of the following : **[10]**

a) Calculate the ESR resonance frequency of an unpaired electron (g = 2) in a magnetic field of 0.335 T.

b) A $^{200}Hg\,^{35}Cl$ molecule emits a 4.4 cm photon when it undergoes a rotational transition from J = 1 $\rightarrow$ J = 0. Find the interatomic distance in this molecule.

c) Find the number of vibrational energy levels below the dissociation limit and hence the dissociation energy of C_2 in both states using the data given below.

	$\overline{we}$ cm^{-1}	xe
Ground state	1641.4	0.00711
Excited state	1788.2	0.00919

d) It takes 10 min to record a dispersive spectrum. How long will it take to record an FTIR spectrum if measurements are made at every $1cm^{-1}$, between $400cm^{-1}$ and $4000\ cm^{-1}$.

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) With suitable example, explain different types of radioactive decay processes.

b) Enlist the modes of interaction of gamma radiation with matter. Discuss Compton scattering.

c) How primary radiolytic products of water are formed? Describe in brief Lea-Gray-Platzman model.

d) Describe scavenging of free radicals in water radiolysis.

e) Describe ultracentrifugation method for separation of isotopes.

Q5) Attempt any three of the following : **[15]**

a) What is design parameter? Give classification of reactor on the basis of fuel and moderator.

b) What is necessity of breeder reactor? Discuss the principle of breeder reactor.

c) Discuss the four factor formula used in reactor technology.

d) Give the principle of radiometric titration. Explain any one radiometric titration with suitable example.

e) Discuss the radioanalytical method to determine the solubility and heat of solution of a sparingly soluble salt.

Q6) Solve any two of the following : **[10]**

a) Find the thickness of $^{63}_{29}Cu$ required to reduce an activity of γ-source from 4000 cpm to 2000 cpm.
[Given : $e^{\mu} = 0.211\ b/e$, ρ of $C_u = 8.96$ g/cc]

b) An alloy containing C_u was irradiated in a nuclear reactor with a neutron flux of $3 \times 10^{11}\ cm^{-1}\ s^{-1}$ for 30 min. The activity observed was 5160 cpm. Calculate percentage of C_u in the given sample.
[Given : t ½ = 12.7 h, σ = 4.56, r = 69.1% and detector efficiency = 10%]

c) A bone sample weighing 10g containing phosphorus was irradiated in a nuclear reactor. Calculate the activity due to ^{32}P if phosphorus in bone is 30%.
[Given : $t_{1/2}$ of ^{32}P = 14.2]

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Total No. of Questions : 6]

SEAT No. :

P398

[Total No. of Pages : 7

[4225] - 202
M.Sc. - I
INORGANIC CHEMISTRY
CH - 230 : Inorganic Chemistry - II
(2008 Pattern) (Semester - II)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logtables and calculators is allowed.***
6) ***Given Atomic number V = 23, Cr = 24, Ni = 28, Ti = 22, Mn = 25, Cu = 29, Fe = 26, Ce = 58, Pm = 61, Yb = 70.***

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Explain the possible transitions in $[V(H_2^0)6]^{+3}$ complex ion and correlate them in terms of Racah Parameter and crystal field splitting parameter.

b) Determine the spin multiplicities of states arising from t_{2g}^2 configuration when infinitely strong octahedral field is relaxed to strong field using Bethe's method of descending symmetry, correlation table and direct product table.

c) Prepare a table of microstates and hence derive the allowed R.S. terms for the $(n-1)\,P^1\,n\,P^1$ configuration.

d) In each of the following pairs of transitions which you would expect to be more intense? Justify.

i) $^4A_2 \longrightarrow {}^4E$ OR $^4A_2 \longrightarrow {}^2E$ in $[Cr(oxalate)_3]^{-3}$

ii) *Cis* $[C_o(en)_2Cl_2]^+$ OR trans $[C_o(en)_2Cl_2]^+$

P.T.O.

e) Calculate degeneracy for the following terms/configurations/states.

i) d^2F^2.

ii) ${}^3T_{ig}$.

iii) ${}^5I$

iv) $3.{}^3E_4$.

v) $(t_{2g})^4\ (eg)^2$

Q2) Answer <u>any three</u> of the following : **[15]**

a) Give the splitting of ${}^4F$ R.S. term in weak cubic field using character table for pure rotational point group and reduction formula.

b) The free gas ion Ti^{+2} has a ${}^3F$ ground term. The ${}^1D$ and ${}^3P$ terms lie respectively 10642 cm^{-1} and 12920 cm^{-1} above it. The energies of the terms are given in terms of Racah parameters.

$E_{({}^3F)} = A - 8B$

$E_{({}^3P)} = A + 7B$

$E_{(D)} = A - 3B + 2C$

calculate the values of B and C for T_i^{+2} ion.

c) Explain the following :

i) The electronic spectral bands of lanthanides and their complexes are almost same.

ii) $KMnO_4$ is intense purple in colour while $MnSO_4$ is Faint pink in colour.

d) Explain which of the following complexes show orbital contribution to magnetic moment. Justify your answer.

i) $[Mn\ (CN)_6]^{-4}$

ii) $[Cu\ (H_2O)_6]^{+2}$

e) Give the full spectroscopic symbol for the ground state term for the following ions.

i) Fe^{+3}

ii) Ni^{+2}

iii) Ce^{+3}

iv) Pm^{+3}

v) Yb^{+3}

Q3) Answer <u>any two</u> of the following : **[10]**

a) Charge Transfer spectra

b) Interelectronic repulsion parameters

c) Quenching of orbital angular moment

SECTION - II

Q4) Answer <u>any three</u> of the following : **[15]**

a) Nature uses different transition metals in different organisms to carry out identical functions. Explain the above statement with suitable example.

b) Give an account of the principles of co-ordination chemistry utilised in bioinorganic chemistry with respect to hard and soft acids and bases.

c) Give an account of ferritin and transferrin.

d) Discuss the use of inorganic compounds as medicines.

e) What are the different binding sites that are present in amino acids for metal binding?

Q5) Write short notes (any three) : **[15]**

a) Communication role of metals.

b) Zinc fingers.

c) Homeo statis.

d) Receptor mediated endocytosis.

e) Detoxification of mercury.

Q6) Draw structures (any five) : **[10]**

a) 4Fe – 4S.

b) $[(Py)_2 Pt (en)]^{+2}$

c) Vit.B_{12}.

d) Enterobactin.

e) Flavin.

f) 18 crown 6.

Character Table for O rotational group

O	E	$6C_4$	$3C_2(=C_4^2)$	$8C_3$	$6C_2$		
A_1	1	1	1	1	1		$x^2+y^2+z^2$
A_2	1	−1	1	1	−1		
E	2	0	2	−1	0		$(2z^2-x^2-y^2$ $x^2-y^2)$
T_1	3	1	−1	0	−1	$(R_x, R_y, R_z); (x, y, z)$	
T_2	3	−1	−1	0	1		(xy, xz, yz)

Correlation Table for the Group O_h

Oh	O	Td	D_{4h}	D2d	C_4^v	C_2^v	D2d	D_2	C2h
A1g	A1	A1	A1g	A1	A1	A1	A1g	A1	Ag
A2g	A2	A2	B1g	B1	B1	A2	A2g	A2	Bg
Eg	E	E	A1g+B1g	A1+B1	A1+B1	A1+A2	Eg	E	Ag+Bg
T1g	T1	T1	A2g+Eg	A2+E	A2+E	A2+B1+B2	A2g+Eg	A2+E	Ag+2Bg
T2g	T2	T2	B2g+Eg	B2+E	B2+E	A1+B1+B2	A1g+Eg	A1+E	2Ag+Bg
A1u	A1	A2	A2u	B1	A2	A2	A2u	A1	Au
A2u	A2	A1	B2u	A1	B2	A1	A1u	A2	Bu
Eu	E	E	A2u+B2u	A2+B2	A2+B2	A1+A2	Eu	E	Au+Bu
T1u	T1	T2	A2u+Eu	B2+E	A2+E	A1+B1+B2	A2u+Eu	A2+E	Au+2Bu
T2u	T1	T1	B2u+Eu	A2+E	B2+E	A2+B1+B2	A2u+Eu	A1+E	2Au+Bu

=

DIRECT PRODUCTS

1. Groups of the form $G \times i$ or $G \times \sigma_h$:
   The g, u or $'$, $''$ additions to the IR symbols in these groups satisfy
   $g \times g = u \times u = g$, $g \times u = u$, $'x' = ''x'' = '$, $'x'' = ''$.

2. Products of the form $A \times A$, $B \times B$, $A \times B$:
   For all groups :
   Letter symbols : $A \times A = A$, $B \times B = A$, $A \times B = B$.
   Subscripts : $1 \times 1 = 1$, $2 \times 2 = 1$, $1 \times 2 = 2$
   except for the B representations of D_2 and D_{2h} where
   $B \times B = B$ and $1 \times 2 = 3$, $2 \times 3 = 1$, $3 \times 1 = 2$.

3. Products of the form : $A \times E$, $B \times E$:
   (a) For all groups : $A \times E_k = E_k$ irrespective of the suffix on A.
   (b) For all groups except D_{4d}, D_{4d}, S_8 :
   $B \times 'E_1 = E_2$, $B \times E_2 = E_1$
   irrespective of the suffix on B. (If the group has only one E representative put $E_1 = E_2 = E$.)
   (c) For D_{4d} :
   $B \times E_1 = E_3$, $B \times E_2 = E_4$, $B \times E_3 = E_2$, $B \times E_4 = E_1$, $B \times E_5 = E_5$
   irrespective of the suffix on B.
   (d) For D_{4d}, S_8 :
   $B \times E_1 = E_3$, $B \times E_2 = E_4$, $B \times E_3 = E_1$
   irrespective of the suffix on B.

4. Products of the form $E \times E$:
   (For groups which have A, B or E symbols without suffixes put $A_1 = A_2 = A$, etc. in the equations below.)
   (a) For O_h, O, T_d, D_{4h}, D_{6h}, C_{6v}, C_{3h}, C_{6d}, S_6, D_{3d}, D_{3h}, D_3, C_{3v}, C_{3h}, C_3 :
   $E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2$; $E_1 \times E_2 = E_1 + E_2 + E_1$.
   (b) For D_{4h}, D_4, C_{4v}, C_{4h}, C_4, S_4, D_{2d} :
   $E \times E = A_1 + A_2 + B_1 + B_2$.
   (c) For D_{4d} :
   $E_1 \times E_1 = E_3 \times E_3 = A_1 + A_2 + E_2$,
   $E_2 \times E_2 = E_4 \times E_4 = A_1 + A_2 + E_4$,
   $E_3 \times E_3 = A_1 + A_2 + B_1 + B_2$,
   $E_1 \times E_2 = E_3 \times E_4 = E_1 + E_2$, $E_1 \times E_3 = E_2 \times E_3 = E_2 + E_4$,
   $E_1 \times E_4 = E_2 \times E_3 = E_2 + E_3$, $E_2 \times E_3 = E_2 \times E_4 = E_1 + E_3$,
   $E_1 \times E_5 = B_1 + B_2 + E_5$, $E_2 \times E_5 = B_1 + B_2 + E_5$.

(*d*) D_{5d}, D_{5h}, D_5, C_{5v}, C_{5h}, C_5 :

$E_1 \times E_1 = A_1 + A_2 + E_2$, $E_2 \times E_2 = A_1 + A_2 + E_1$,

$E_1 \times E_2 = E_1 + E_2$.

(*e*) For D_{4d}, S_8

$E_1 \times E_1 = E_3 \times E_3 = A_1 + A_2 + E_2$,

$E_2 \times E_2 = A_1 + A_2 + B_1 + B_2$

$E_1 \times E_2 = E_2 \times E_3 = E_1 + E_3$, $E_1 \times E_3 = B_1 + B_2 + E_2$.

5. Products involving the T (or F) representations of O_h, O and T_d

$A_1 \times T_1 = T_1$, $A_1 \times T_2 = T_2$, $A_2 \times T_1 = T_2$, $A_2 \times T_2 = T_1$,

$E \times T_1 = E \times T_2 = T_1 + T_2$.

$T_1 \times T_1 = T_2 \times T_2 = A_1 + E + T_1 + T_2$,

$T_1 \times T_2 = A_2 + E + T_1 + T_2$.

6. The complete results for O are :

O	A_1	A_2	E	T_1	T_2
A_1	A_1	A_2	E	T_1	T_2
A_2	A_2	A_1	E	T_2	T_1
E	E	E	A_1+A_2+E	T_1+T_2	T_1+T_2
T_1	T_1	T_2	T_1+T_2	$A_1+E+T_1+T_2$	$A_2+E+T_1+T_2$
T_2	T_2	T_1	T_1+T_2	$A_2+E+T_1+T_2$	$A_1+E+T_1+T_2$

Total No. of Questions : 6]

SEAT No. :

P399

[Total No. of Pages : 4

[4225] - 203
M.Sc. - I
ORGANIC CHEMISTRY
CH - 250 : Synthetic Organic Chemistry and Spectroscopy
(2008 Pattern) (Semester - II)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

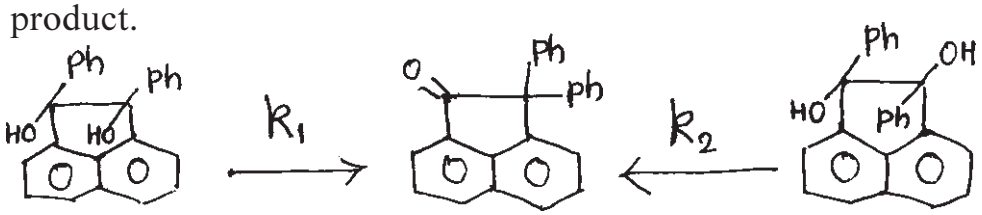
SECTION - I

Q1) Explain any four of the following : **[16]**

a) β-Hydroxy esters are prepared by organo zinc and not by organo magnesium reagents.

b) 1-methylcyclohexeneontreatment with $H_2O/H^{\oplus}$ gives 1-methylcyclohexanol where as with B_2H_6 followed by $H_2O_2/NaOH$ gives 2-methyl-cyclohexanol.

c) Benzaldehyde oxime on treatment with PCl_5 gives cyanobenzene as major product.

d) 

Comment on relative magnitudes of K_1 & K_2.

e) Give significance of Wittig reaction with suitable examples.

Q2) Write short note on any three of the following : **[12]**

a) Wilkinson's Catalyst.

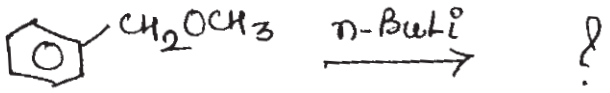
b) Claisen Rearrangement.

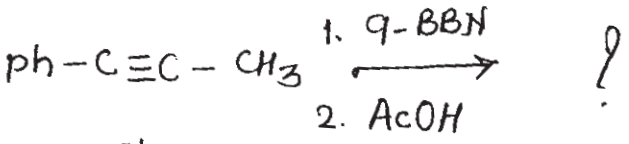
c) Generation and fate of nitrenes.

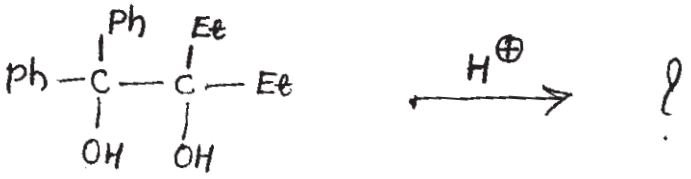
d) Use of organo Lithium in organic synthesis.

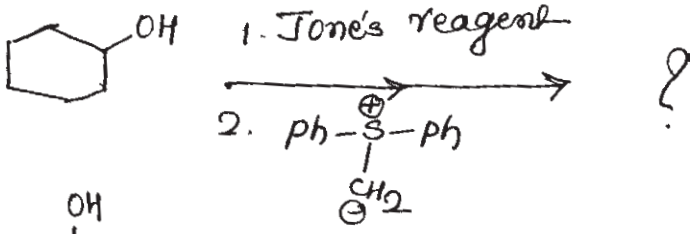
P.T.O.

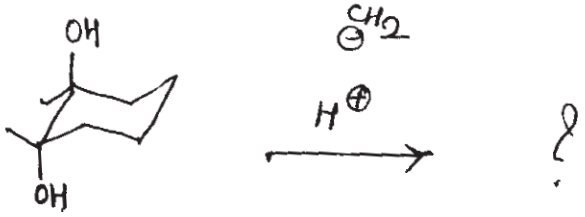
Q3) Predict the product and suggest the mechanism for any four of the following : **[12]**

a) 

b) 

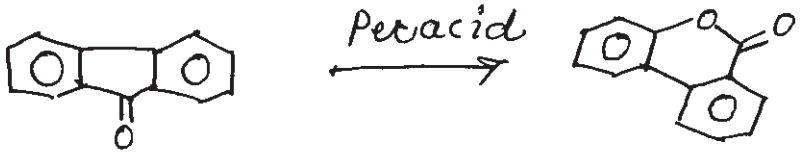
c) 

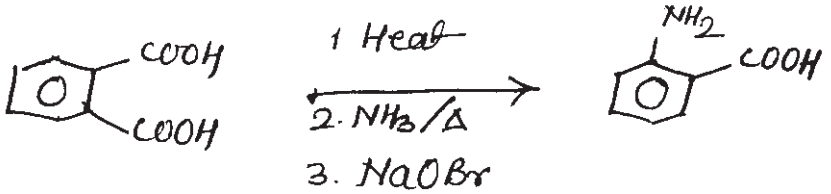
d) 

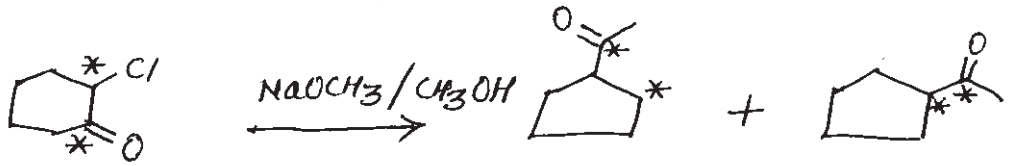
e) 

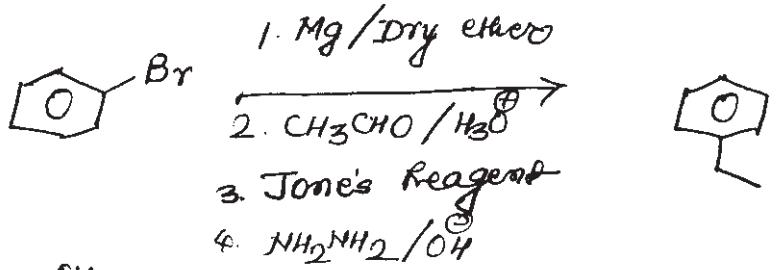
SECTION - II

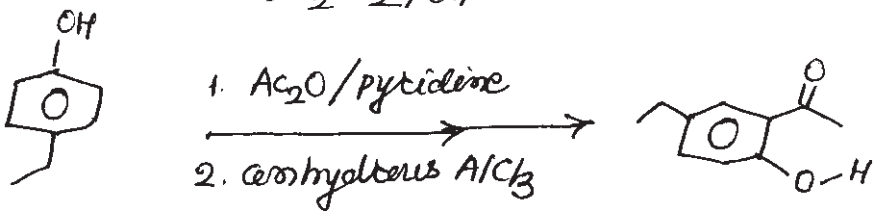
Q4) Suggest mechanism for <u>any four</u> of the following : **[12]**

a) 

b) 

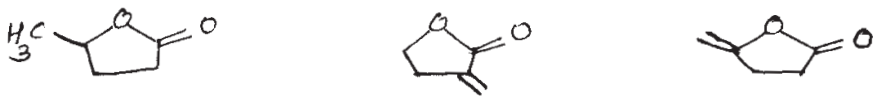
c) 

d) 

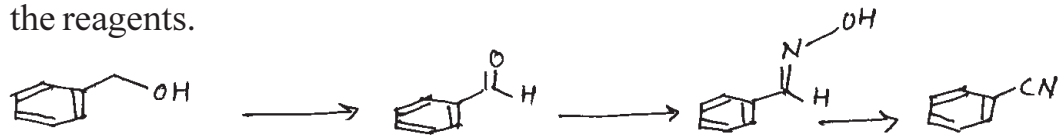
e) 

Q5) Attempt <u>any four</u> of the following : **[16]**

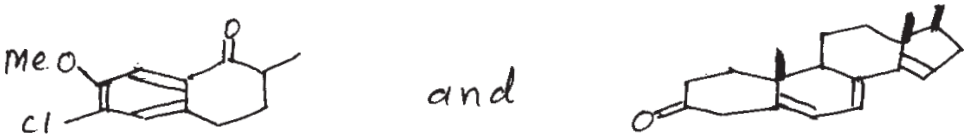
a) Assign the IR absorption values 1761, 1810, 1773cm^{-1}, to the following compounds with proper justification.



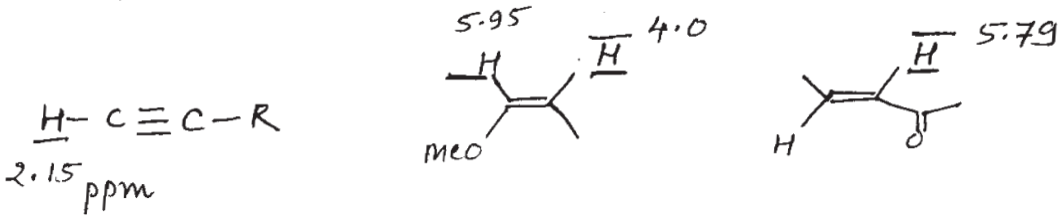
b) How will you monitor the following reaction sequence by IR. Suggest the reagents.



c) Calculate the λ_{max} for the following, show your calculations.



d) Explain the chemical shift of underlined protons.



e) M-Nitrophenol in neutral solution absorbs at 330nm while in alkaline solution absorbs at 380nm, in contrast p-nitrophenol has λ_{max} 320nm in neutral solution and 400nm in alkaline solution. Explain.

Q6) Deduce the structures of <u>any three</u> of the following compounds using spectral data and justify your answer. **[12]**

a) M.F : $C_{10}\ H_{12}\ O_2$
IR : 1738, 1600, 1500 cm^{-1}
PMR : 1.3 (t, 7.2 Hz 3H)
2.9 (s, 2H)
4.15 (q, 7.2 Hz 2H)
7.25 (broad 5H)

b) M.F : $C_8\ H_7\ N$
UV : 235nm ($\in$ = 15000)
IR : 2220, 1620, 1510 cm^{-1}
PMR : 2.4 (s, 15mm)
7.2 (d, J = 8Hz, 10mm)
7.5 (d, J = 8Hz, 10mm)

c) M.F : $C_9\ H_8\ O_2$
UV : 260nm, ($\in$ = 13,000)
IR : 3200 - 2600 (b), 1710, 1630, 1590, 1495 cm^{-1}
PMR : 5.65 (d, 14 Hz, 1H)
6.60 (d, 14 Hz 1H)
7.35 (t, 8Hz 2H)
7.52 (m, 1H)
7.70 (dd, 8 & 2Hz, 2H)
12.30 (bs, 1H)

d) M.F : $C_9\ H_{10}\ O_2$
shows, positive $FeCl_3$ and Iodoform test.
UV : 245nm, ($\in$ = 13,000)
IR : 3200 (b), 1690, 1600, 1490 cm^{-1}
PMR : 2.2 (s, 3H)
2.41 (s, 3H)
6.84 (d, 8Hz, 1H)
7.61 (dd, 8 and 2Hz, 1H)
7.75 (d, 2Hz, 1H)
11.10 (s, 1H)

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Total No. of Questions : 5]

SEAT No. :

P400

[Total No. of Pages : 3

[4225] - 301

M.Sc.

PHYSICAL CHEMISTRY

CH - 310 : Quantum Chemistry and Solid State Chemistry

(2008 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***Answers to the Two sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic table, calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Which of the following functions are eigenfunctions of $\frac{d^2}{dx^2}$? Give eigenvalues.

i) e^x ii) x^2 iii) $\sin x$ iv) $3\cos x$ and v) $\sin x + \cos x$.

b) Show that if two operators $\hat{A}$ and $\hat{B}$ are Hermitian, then their product $(\hat{A}\hat{B})$ is also Hermitian if $\hat{A}$ and $\hat{B}$ commute.

c) Define ladder operator $\hat{M}_{\pm}$. Derive the relations $[\hat{M}^2, M_{\pm}] = 0$, $[M_z, M_{\pm}] = i\hbar\ \hat{M}_{\pm}$ and $[M_+, M_z] = 2\hbar\ \hat{M}_2$.

d) Formulate the Hamiltonian operator for Be^{+2} and H_2 molecule. State the terms involved in each case.

e) State and prove the variation theorem.

f) Derive the relation $E_i^1 = \frac{\int \Psi_i^*(0) H^1 \Psi_i^{(0)} d_7'}{\int \Psi_i^*(0) \Psi_i^{(0)} d_7}$ where E_i^1 is the first order perturbation energy for non-degenerate states.

Q2) Attempt any four of the following : **[20]**

a) Find the term symbols for

i) $L = 2,\ S = \frac{1}{2}$ and

ii) $L = 1,\ S = \frac{3}{2}$

b) Sketch the molecular orbitals for butadiene on the basis of HMO theory. Deduce the energies of these orbitals on the basis of secular determinant.

c) State Hiickel's (4m + 2) rule. Explain the mnemonic model used for monocyclic conjugated polyenes to deduce the separation of the MO energy levels.

d) Why is $K_2C_8H_8$ stable but not cyclo-octatetraene?

e) Explain the following :
   i) Coulomb integral.
   ii) Exchange integral.
   iii) Overlap integral and
   iv) Normalized integral.

f) Evaluate the delocalization energy of benzene on the basis of Hiickel's approximation.

SECTION - II

Q3) Attempt any three of the following : **[15]**

a) Derive the expression for the number of Frenkel defects present in a crystal at a given temperature.

b) What are line defects? Give and describe various line defects.

c) Compare the resistivities of annealed and unannealed Cu - Au alloys.

d) Distinguish between intrinsic and extrinsic semiconductors.

e) Describe any two methods with their merits and demerits for crystal growth from melts.

Q4) Attempt any three of the following : **[15]**

a) Explain the hysteresis loop observed for the magnetization of an linsulator crystal with a suitable diagram.

b) Discuss small angle boundaries, stacking faults and secondary recrystallization in plane defects.

c) Explain the thermal properties of a crystal.

d) Explain the mechanism for the reactions occuring at the -
   i) Interphase AgI/Ag_2HgI_4 for the reaction between AgI and HgI_2.
   ii) Interphases Cu/CuCl and CuCl/AgCl for the reaction between Cu (s) and AgCl (s).

e) Describe any one experimental method adopted to study the kinetics of decomposition of a single solid.

Q5) Solve any two of the following : **[10]**

a) The density of schottky defects in a certain sample of sodium chloride is 5×10^{11} per m^3 at 25°C. If the observed interionic ($Na^+ - Cl^-$) distance is $2.82\ \mathring{A}$, what is the average energy required to create one schottky defect?

b) Calculate the relaxation time for copper.
[Given : Density = 8.92 gcm^{-3}, At wt of Cu = 63.5]

c) Calculate the mean free time for an electron in a semiconductor crystal having drift velocity 6.25×10^2 cm^2/volt - sec.

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Total No. of Questions : 6]

SEAT No. :

P401

[Total No. of Pages : 3

[4225] - 302

M.Sc.

PHYSICAL CHEMISTRY

CH - 311 : Nuclear and Radiation Chemistry

(2008 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***Answers to the Two sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic table, calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

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13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Explain the charge distribution on the fission fragments and deduce the expressions for the atomic numbers of the primary fission fragments.

b) What is nuclear fission? Explain the carbon-nitrogen cycle.

c) Define reaction cross section. Explain the variation of neutron capture cross section with the energy of neutron.

d) How is the excitation energy of a compound nucleus calculated? Describe the distribution of excitation energy among the nucleons.

e) Write the sequence of filling of nuclear orbitals. What is necessity of proposing spin-orbit coupling?

Q2) Attempt any three of the following : **[15]**

a) Discuss the applications of semiemperical mass equation.

b) What is the role of moderator and reflector in the reactor?

c) Write a note on coolants and control material.

d) Draw and explain the experimental set up of PIXE technique. What are the demerits of this technique?

e) Discuss how surface analysis can be done using Rutherford back scattering process.

Q3) Attempt any two of the following : **[10]**

a) ^{14}N has an excited state at 12.8 MeV. At what energy of the incident particle (LS) would resonance capture occur in the case of $^{10}B\ (\alpha, n)^{13}N$. Given : Mass of ^{10}B = 10.012939 amu, mass of α-particle = 4.002604 amu, mass of ^{14}N = 14.003074 amu.

b) In the fission of ^{236}U into fragments of atomic mass numbers 95 and 137 daltons and 4 neutrons, the end stable products are $^{95}_{42}\text{Mo}$ and $^{137}_{56}\text{Ba}$. Find the initial fragments of fission.

c) Taking the energy released per uranium fission is 200 MeV, compute the number of uranium atoms that must fission per second, such that the power generated equals 10 MW.

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) Explain the working of Tandem Van de Graaff generator.

b) Draw a schematic diagram of synchrotron and explain the function of each component in it.

c) Discuss the role of pulse height analyzer in scintillation counter.

d) What is annealing? Describe annealing mechanism for Szilard-Chalmer's reaction.
e) Write a note on Lidrifted Germanium detector.

Q5) Attempt any three of the following : **[15]**

a) Write the various reactions in radiolysis of Cupric sulphate solution.
b) What are somatic effects of radiations? Give an account of short term and long term effects of radiations.
c) Discuss the reasons for chernobyl nuclear accident.
d) Write a note on personal dosimetry.
e) Enlist various radiation protecting material. How thickness of protecting material is calculated for reduction of dosy.

Q6) Solve any two of the following : **[10]**

a) Find out dose due to 250 mci Mn-56 source at a distance of 2 meters. Given : gamma energy = 847, 1811 and 2111 keV.
b) A radiation worker is exposed to following radiations in 3 months. 0.001 Gy due to α particles 1.5 mR due to γ rays 0.01 rad due to β rays. Find out total effective dose absorbed by him. Is it permissible?
c) Find out thickness of lead needed to decrease the activity of 50,000 cpm from CS - 137 source to 12,000 cpm. Given : $e^{\mu} = 0.211$ b/e, Z of pb = 82, A of pb = 207, density of lead = 11.35 gcm^{-3}.

Total No. of Questions : 6]

SEAT No. :

P402

[Total No. of Pages : 3

[4225] - 303

M.Sc.

PHYSICAL CHEMISTRY

CH - 312 : Advanced Instrumental Methods of Analysis

(2008 Pattern) (Sem. - III)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) *Answers to the Two sections should be written in SEPARATE answer books.*
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3) *Figures to the RIGHT SIDE indicate FULL marks.*
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5) *Neat diagrams must be drawn WHEREVER necessary.*

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			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Answer the following (any three) : **[15]**

a) Explain the criteria for the choice of irradiation sources used in NAA.

b) Discuss the limitations of NAA.

c) Define cross-section (σ). Explain geometric and reaction cross-section in NAA.

d) Draw a neat labelled diagram of an X-ray absorption apparatus and discuss the advantages of using radioactive sources.

e) Explain the principle and applications of SEM and STEM techniques.

Q2) Answer the following (any three) : **[15]**

a) State the principle of ESCA. Explain the ways by which an excited ion in ESCA relaxes.

b) Define and explain the terms Fermi level, binding energy and work function.

c) Describe the retarding potential analyzer used in ESCA.

d) Derive the expression $\frac{m}{z}=\frac{B^2r^2}{2E}$ used in the magnetic analyzer in mass spectrometry.

e) Discuss any one of the hard methods of ionization used in mass spectrometry.

Q3) Solve the following (any two) : **[10]**

a) A time-of-flight mass spectrometer has a flight path 125.0 cm and an accelerating potential of 1850 V. Calculate the time required for ions with m/z 98 and 125 to strike the detector after emission from the source.

b) Calculate the mass absorptive coefficient of an alloy which consists of 23% nickel and 48% copper at the wavelength corresponding to Kα radiation of copper.

(Given : μ_mNi = 49.3 cm^2/g and μ_mCu = 52.7 cm^2/g)

c) Calculate the geometric cross-section for an atom from the following NAA data.

Given : Atomic weight of an atom = 64, Ro = 1.39×10^{-13} cm.

SECTION - II

Q4) Attempt <u>any three</u> of the following : **[15]**

a) What is a plasma? State the advantages of emission spectroscopy based on plasma over flame and electro thermal methods.

b) Draw a neat labelled diagram of a typical ICP spectrometer and describe its working.

c) Explain the effect of heteroatoms and substituents on the luminescence of an analyte.
d) What is chemiluminescence? Discuss its mechanism.
e) Explain how thermogravimetry data can be used to evaluate the kinetic parameters.

Q5) Attempt any three of the following : **[15]**

a) State the principle of thermometric titrations. Describe a typical thermometric titration.
b) With a neat labelled diagram, describe the analysis by controlled potential coulometry technique.
c) State the principle of a coulometric titration. What are the fundamental requirements of the titration?
d) What are voltammetric principles? Describe the construction and the working of rotated ring-disc electrode used in voltammetric analysis.
e) What is the voltage ramp used in differential pulse voltammetry? How is the technique different from normal pulse voltammetry?

Q6) Solve any two of the following : **[10]**

a) The coulometric assay of Nicotinamide adenine dinucleotide (NAD^+) at constant potential by reduction to the dimer $(NAD)_2$ can be performed with the following reaction :

$2\ NAD^+ + 2e^- = (NAD)_2$

If the area under the current - time curve for the reduction of a 15 ml aqueous solution of NAD^+ is 54.3 mA. min, calculate the concentration of NAD^+ in the sample.

b) The thermal curve of a 130.0 mg sample that contained a mixture of $CaC_2O_4 . H_2O$ (MW = 146.12) and a thermally stable salt had a mass loss Δm of 7.0 mg at an onset temperature of about 140ºC corresponding to vapourization of water. Determine the percentage (W/W) of $CaC_2O_4 . H_2O$ in the sample.
[At Wts : Ca = 40, C = 12, O = 16]

c) The initial current of 90 mA decreases exponentially with K = 0.0058 sec^{-1} and the titration time is 714 sec. How many milligrams of Uranium (VI) are reduced to Uranium (IV)? (At Wt of U (VI) = 238).

Total No. of Questions : 5]

SEAT No. :

P403

[Total No. of Pages : 3

[4225] - 304

M.Sc.

PHYSICAL CHEMISTRY

CH - 314 : Polymer Chemistry

(2008 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***Answers to the TWO sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic tables/calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Discuss the classification of polymers.

b) Define the terms - polymer, degree of polymerization, heterochain polymer.

c) Derive the copolymer equation.

d) Describe Flory-Krigbaum theory of dilute polymer solutions.

e) Explain the instantaneous composition of polymers.

Q2) Attempt any three of the following : **[15]**

a) What is glass transition temperature? Describe any one method of its determination.

b) Discuss the presence of defects in crystalline polymer.

c) What is rheology? Discuss the different phenomena of rheological behaviour of polymer.

d) Distinguish between step and chain polymerization.

e) Describe entropy and heat of mixing of polymer solution.

Q3) Solve any two of the following : **[10]**

a) The suspension contains equal number of molecules with molecular weight 15000. Calculate $\overline{Mn}$ and $\overline{Mw}$ of particles with molecular weight 15500 and 30500.

b) A polymer with molecular weight 100000 obeys Mark-Houwink equation. Calculate relative Viscosity at concentration 0.5 g/dl.
[Given : $K = 1.12 \times 10^{-4}$; $\alpha = 0.70$, Huggin's constant = 0.3]

c) One mole of vinyl acetate is co-polymerised with three moles of vinyl bromide, the monomer reactivity ratios are 0.20 and 1.60 respectively. Calculate instantaneous composition of polymer.
[At.Wt : C = 12, H = 1, O = 16, Br = 79.9]

SECTION - II

Q4) Attempt any four of the following : **[20]**

a) Discuss the use of DTA technique in the analysis of polymer.

b) What is extrusion? Explain plastic extrusion.

c) Describe the process of calendering with heat diagram.

d) Discuss the use of carbon black as a reinforce ment filler for rubber.

e) Write a note on X-ray diffraction in analysis of polymers.

f) Describe the principle of vapour-phase-osmometry.

Q5) Attempt <u>any four</u> of the following : **[20]**

a) What is molding? Discuss the compression molding.

b) Write a note on : 'Vulcanization'.

c) What are the effects of irradiation on degradation and cross linking of polymers?

d) Explain any one technique used for the production of reinforced plastic.

e) Define the following textile terms :

i) Fibre.

ii) Denier.

iii) Tenacity.

iv) Crimp and

v) Moisture regain.

f) Explain the molecular weight determination method by viscosity measurement.

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Total No. of Questions : 4]

SEAT No. : ____

P405

[Total No. of Pages : 2

[4225] - 306

M.Sc. - II

INORGANIC CHEMISTRY

CH - 326 : Organometallic Compounds of Transition Metals and Homogeneous Catalysis

(Semester - III) (2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory and equal marks.***
2) ***Figures to the right indicates full marks.***
3) ***At. Nos –Cr = 24, Mn = 25, Fe = 26, Rh = 45, W = 74.***

Q1) Attempt any four of the following : **[20]**

a) Consider the 18 electron rule as a guide and determine the value of 'n' in the following complexes.

i) $Na_2Fe(CO)_n$,

ii) $MnBr(CO)_n$,

iii) $W(\eta^6 - C_6H_6)\ (CO)_n$,

iv) $Rh(\eta^5 - C_5H_5)(CO)_n$,

v) $Cr(\eta^3 - C_5H_5)(CO)_n(CH_3)$

b) Determine the number of metal-metal bonds in the following complexes which obey the 18 electron rule and draw the structure.

i) $(CO)_2\ Rh(\mu - Cl)_2\ Rh(CO)_2$;

ii) $(\eta^5 - C_5H_5)\ (CO)\ Fe(\mu - CO)_2\ Fe(CO)\ (\eta^5 - C_5H_5)$

c) Photolysis of $[\eta^5 - Cp\ Fe\ (CO)_2]_2$ at –78°C results in the loss of a colourless gas and formation of an iron containing product having a single carbonyl band at 1785 cm^{-1}. Suggest a structure for the product.

d) Give the systematic classification of σ-bonded T.M. hydrocarbyls.

e) Give the typical reactions of Zeise's salt.

P.T.O.

Q2) Attempt <u>any four</u> of the following : **[20]**

a) Explain the Monsanto Acetic acid process.

b) How are metal carbonyls prepared? Discuss the properties of metal carbonyls. What are uses of metal carbonyls?

c) What is Olefin epoxidation? Which T.M. complexes play important role in this reaction?

d) What do you mean by hydrocyanation reaction? Which catalysts are used for this reaction. Explain with one example.

e) Comment on the statement 'NMR spectroscopy is an eminently suitable technique to study fluxional behaviour of OMC's.

Q3) Attempt <u>any four</u> of the following : **[20]**

a) Explain with the help of suitable examples, the role of OMC's as protecting and Activating agents.

b) What do you mean by sandwich compounds? Give synthetic methods of their preparation.

c) Comment on role of copper (II) chloride in Wacker process.

d) Discuss briefly the possible mechanism for metathesis of propene.

e) Comment on the therapeutic properties of :

i) Mercurochrome, ii) Cisplatin,

iii) Salvarsan, and iv) Silatrane

Q4) a) Write notes on (any three) : **[15]**

i) Applications of the suzuki cross-coupling reaction.

ii) Repees catalyst.

iii) Group V organometallics in medicine.

iv) Tolman's catalytic cycle.

b) Draw the following structure : **[5]**

i) $[W(\eta^6 - C_6H_6)\ (CO)_2]_2$.

ii) $[(\eta^1 - C_5H_5)\ (\eta^3 - C_5H_5)\ (\eta^5 - C_5H_5)\ M_oNO]$.

iii) $[(\eta^5 - C_5H_5)_3\ Ni_3(CO)_2]$.

iv) $[(\eta^5 - C_5H_5)\ Ir\ H_2PMe_3]$

v) $[Fe(CO)_5]$

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Total No. of Questions : 4]

SEAT No. : ____

P406

[Total No. of Pages : 3

[4225] - 307

M.Sc. - II

INORGANIC CHEMISTRY

CH - 330 : Coordination Chemistry, Magnetism and Reaction Mechanism

(Semester - III) (2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of logarithmic tables and calculator is allowed.***

Q1) Attempt any four of the following : **[20]**

a) What are the basic assumptions of CFT? Discuss the crystal field splitting of an octahedral and square planar complex.

b) Discuss the effect of π-bonding on the value of Δ in an octahedral complex with the ligands capable of forming the π-bond.

c) Explain the terms :

i) M-O-M bridge angle

ii) solute-solvent interaction

d) Explain the difference between antiferromagnetic spin-spin exchange and spin pairing.

e) Explain : "$Mn_2(CO)_{10}$ is diamagnetic".

P.T.O.

Q2) Attempt <u>any four</u> of the following : **[20]**

a) Draw the structure of following molecules and state whether they are paramagnetic or diamagnetic.

i) $MO_2(CO)_8$, ii) $[Rh(PPh_3)_2\ Cl_2]$

iii) $[Cr\ (NH_3)_5 < 1]Cl_2$, iv) $[Rh\ (acac)\ (C_2H_4)_2]$

v) $K_3[Cr\ (C_2O_4)_3]$

(At. No : Cr = 24, Mo = 42, Rh = 45, K = 19)

b) Give the characteristic properties of diamagnetic, paramagnetic, ferromagnetic and antiferromagnetic substances.

c) What are mixed valence compounds? How they are classified?

d) Why is it that oxovanadium (IV) forms complexes which are involved in a weak ferromagnetic exchange.

e) Explain : why certain Ni(II) complexes show anomalous magnetic moment.

Q3) Answer <u>any four</u> of the following : **[20]**

a) Write a note on - complementary and Non-complementary reactions.

b) Give the difference between SN^1 and SN^2 mechanisms for substitution reaction in octahedral complexes.

c) Discuss the role of solvent in substitution reaction in square planar complexes.

d) Rate constant for the exchange of a single water molecule in hexa-aquo high spin T.M. cations are as follows :

Metal ion	Rate Constant (S^{-1} at 25°C)
V^{2+}	1.2×10^2
Ni^{2+}	3.6×10^4
Cr^{2+}	8.3×10^9
Cu^{2+}	7.4×10^9

Give explaination for this observation.

e) What is trans effect? How will you explain it on the basis of π-bonding theory.

Q4) Attempt <u>any four</u> of the following : **[20]**

a) Explain two electron transfer reactions.

b) Write a note on polarisation theory.

c) Explain in brief the mechanism of photographic process.

d) Discuss the relationship between the 'd' electron configuration of a metal and the liability of its complex.

e) Choose the correct answer and rewrite the statement :

1) From the following complexes which complex undergoes isomerisation reaction.

   a) $[Co(NH_3)_5Cl]Cl_2$

   b) trans $[Co(en)_2Cl_2]^+$

   c) $[Pt\ Cl_4]^{-2}$

2) Which theory gives the theoretical explaination of transeffect.

   a) Polarisation theory

   b) Lewis theory

   c) Dalton theory

3) $[Fe(CN)_6]^{-4} + [Ir\ Cl_6]^{-2} \rightarrow [Fe(CN)_6]^{-3} + [Ir\ Cl_6]^{-3}$ is an example of :

   a) outer sphere electron transfer,

   b) Inner sphere electron transfer,

   c) Base hydrolysis.

4) In base hydrolysis reaction, the conjugate pairs are:

   a) NH_3/NH_2^- and OH^-/H_2O,

   b) NH^+_4/NH_3 and OH^-/H_3O

   c) Both ⓐ and ⓑ

5) $[CH_3Mn\ (CO)_5] + PPh_3 \rightarrow (CH_3CO)Mn(CO)_4(PPh_3)$ is an example of:

   a) Anation reaction,

   b) Free radical reaction,

   c) Insertion reaction.

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Total No. of Questions : 4]

SEAT No. : ____

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[Total No. of Pages : 2

[4225] - 308

M.Sc. - II

INORGANIC CHEMISTRY

CH - 331 : Structural Methods in Inorganic Chemistry

(Semester - III) (2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Use of calculators is allowed.***

Q1) Answer the following (any four) : **[20]**

a) Explain the significance of zero field splitting and Kramer's degeneracy in ESR.

b) How can NMR be used to study linkage isomerism in metal complexes.

c) Explain how NQR can be used to determine (i) nature of chemical bond in a compound (ii) structure of Grp III halides.

d) "S electron density at the nucleus is the main factor affecting the chemical shifts in Mössbauer spectroscopy". Justify giving suitable examples.

e) Calculate the ESR frequency of an unpaired electron in a magnetic field of 3500 G given $g = 2$, $h = 6.627 \times 10^{-34}$ JS.

Q2) Attempt (any four) : **[20]**

a) A thermal curve of a 125.70 mg sample containing $CaC_2O_4.H_2O$ and a thermally stable salt showed a weight loss $\Delta_m = 6.98$ mg at an onset temperature of about 140°C, corresponding to the vaporization of water. Determine the percentage w/w of $CaC_2O_4.H_2O$ in the sample.

b) Explain the principle of SEM.

P.T.O.

c) Draw and explain the ESR of a Mn(II) complex.

d) ^{1}H nmr of $Fe(CO)_3$ ($\eta^4 - C_4H_8$) displays a singlet at δ 5.2 at room temperature which splits to give two broad signals at δ 5.6 and δ 4.3 at –145°C. Draw the structure of the complex and explain the above observation.

e) Explain the cyclic voltamogram of k_3 $Fe(CN)_6$ in 1N KNO_3 scanned between 0.8 to –0.15v.

Q3) Answer the following (any four) : **[20]**

a) Explain the voltamogram of $Cp_2(CO)$ in acetonitrile.

b) Explain how DTA curves can be used to measure

i) Heat of reaction

ii) Specific heat.

c) What is the difference between 'g' and 'G' values in ESR? Explain their significance.

d) Sketch and explain the ^{31}P nmr of HPF_2 if

i) $J_{p\text{-}F} > J_{P-H}$

ii) $J_{P-H} > J_{p-F}$

e) With the help of suitable energy level diagram, explain the transitions for quadrupole nucleus with I = 1 under the following conditions

i) $\eta = 0, H_0 = 0$

ii) $\eta \neq 0, H_0 = 0$

iii) $\eta \neq 0, H \neq 0$

Q4) Write notes on (any four) : **[20]**

a) Applications of XRD

b) Applications of thermal methods.

c) Photoelectron spectroscopy.

d) DSC

e) Spin-Spin coupling in NMR.

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Total No. of Questions : 4]

SEAT No. : ____

P408

[Total No. of Pages : 2

[4225] - 309

M.Sc. - II

INORGANIC CHEMISTRY

CH - 332 : Bio-Inorganic Chemistry : Inorganic Elements in the Chemistry of Life

(Semester - III) (2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***

Q1) Answer any four : **[20]**

a) With the help of S_4 cycle, explain the four steps involved in the oxidation of water in photosynthesis.

b) Give comparitive account of types of copper proteins.

c) Illucidate the active site structure and function of enzyme urease.

d) Explain in detail the fundamental interactions of metal complexes with nucleic acids.

e) What is the role of iron in neurodegenerative diseases?

Q2) Attempt the following (any four) : **[20]**

a) Discuss the chemistry of cobalamins.

b) With the help of suitable examples, describe any two non-technetium based radiopharmaceuticals.

c) Describe the structure and function of carbonic anhydrase with mechanism.

d) Explain the catalytic cycle of Tyrosinase with respect to its mono-oxygenase and dioxygenase activity.

e) What is intercalation? Describe any two techniques which can identify and quantify intercalation.

P.T.O.

Q3) a) Attempt <u>any five</u> : **[15]**

i) Give an account of different modes of DNA-binding by metal complexes with suitable examples.

ii) Name at least two diseases caused by deficiency and excess of copper and zinc.

iii) Write in short three applications of radiopharmaceuticals.

iv) Enlist the functions of catalases and peroxidases.

v) Explain important aspects of magnetic resonance imaging.

vi) Draw active site structure of galactose oxidase and its reaction.

b) Choose the correct options from the following : **[5]**

i) The trivalent ion of lanthanoid element which is used as NMR contrasting agent is :

A) Gadolinium B) Technetium

C) Cerium D) Lutetium

ii) In cytochrome - C Oxidase, the number of iron and copper centers is :

A) 2, 2 B) 2, 3

C) 1, 2 D) 1, 1

iii) The metal ion present in urease is :

A) Zn B) Ni

C) Co D) Fe

iv) The enzyme which removes c-terminal amino acid from a peptide is :

A) Carbonic anhydrase B) Carboxypeptidase

C) Zymase D) All

v) Elongation of DNA on cisplatin binding is monitored by :

A) Absorption titration B) Viscosity measurement

C) Fluorescence titration D) NMR spectroscopy

Q4) Write notes on (any four) : **[20]**

a) Metallofootprinting agents.

b) Radiolabelling on antibodies.

c) Benefits and challanges of MRI in molecular imaging.

d) SOD.

e) Biomethylation of mercury.

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Total No. of Questions : 6]

SEAT No. : ____

P409

[Total No. of Pages : 3

[4225] - 310
M.Sc. - II
ORGANIC CHEMISTRY
CH - 350 : Organic Reaction Mechanism
(2008 Pattern) (Sem. - III)

Time : 3 Hours] ***[Max. Marks : 80***

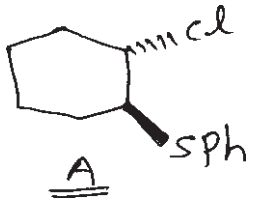
Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Attempt any four of the following : **[12]**

a) The rate of hydrolysis of chloride A is lowered by substitution of P-NO_2 group in the benzene ring. Explain.



b) Enamine approach is preferred for α-alkylation of ketones. Explain.

c) Give the significance of Hammett equation.

d) The ρ value for the hydrolysis of substituted benzomide is +ve for base catalysed but –ve for acid catalysed reaction.

e) Calculate how much faster p-bromoaniline is benzoylated in benzene at 25°C than p-nitroaniline using the following data

$\sigma p - NO_2 = 0.78$, $\sigma p - Br = 0.23$, $\rho = -2.69$

Q2) Write short note on any three of the following : **[12]**

a) Newmann's rule of six.

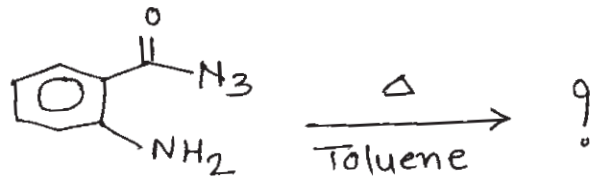
b) Mannich reaction.

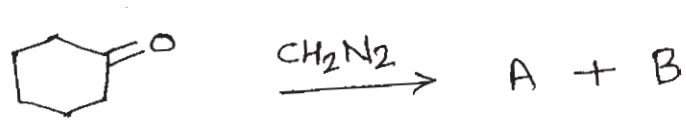
c) Pinacol rearrangement.

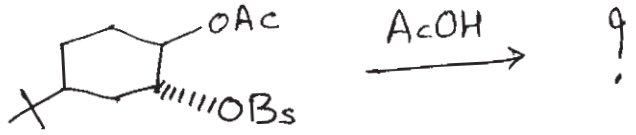
d) Curtius rearrangement.

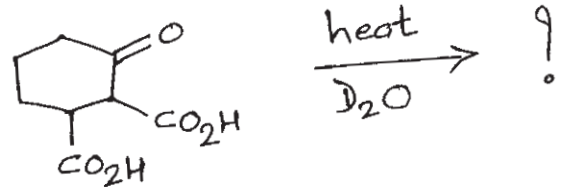
P.T.O.

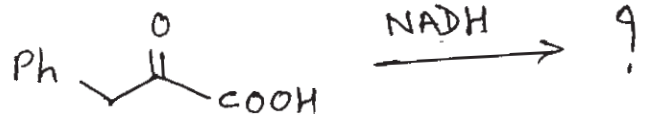
Q3) Predict the product with mechanism for <u>any four</u> of the following : **[16]**

a) 

b) 

c) 

d) 

e) 

SECTION - II

Q4) Explain <u>any four</u> of the following : **[12]**

a) H_3COCH_2–Cl reacts with iodide ion in acetone several thousand time faster than H_3CCH_2–Cl.

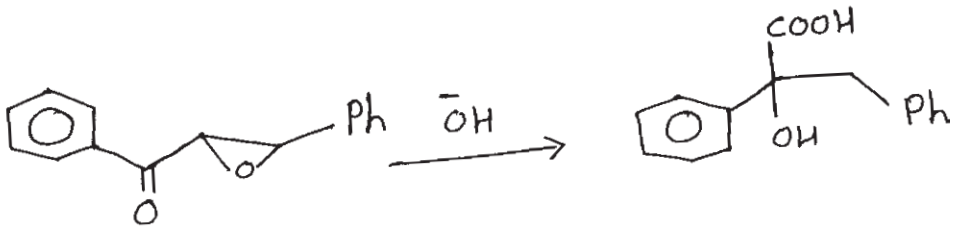
b) When the cannizzaro reaction is carried out in D_2O, the benzyl alcohol contains no deuterium in methylene group.

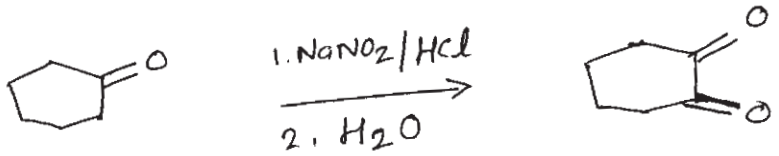
c) Amidines are stronger bases than amines.

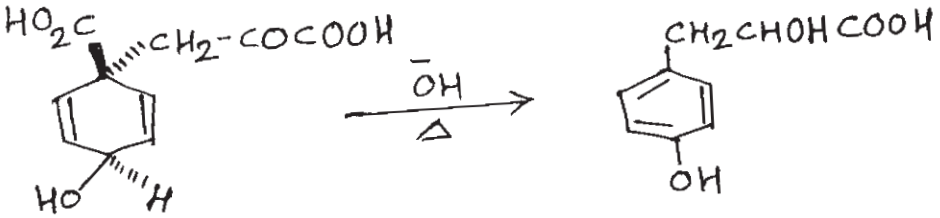
d) NADH is used for reductive biotransformation.

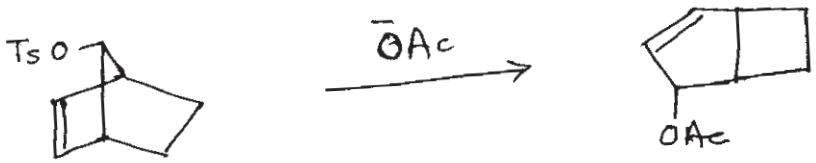
e) Acetaldehyde, when reacts with large excess of formaldehyde in presence of base forms pentaerythritol.

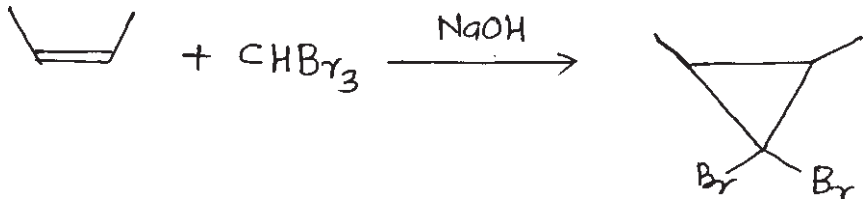
Q5) Suggest the mechanism for <u>any four</u> of the following : **[16]**

a) 

b) 

c) 

d) 

e) 

Q6) Answer <u>any four</u> of the following : **[12]**

a) Ester hydrolysis by BAL2 mechanism is extremely rare. Explain.

b) Benzoin condensation fails when $-NMe_2$ group is present at the para position of aromatic aldehyde. Explain.

c) Explain the formation of cyclopropanone as intermediate in the favorskii rearrangement of 2-chloro cyclohexanone.

d) Explain the relative acidities of methyl aceto-acetate and acetoacetamide.

e) Explain the use of FAD in biotransformations.

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Total No. of Questions : 6]

SEAT No. : ____

P411

[Total No. of Pages : 4

[4225] - 312

M.Sc. - II

ORGANIC CHEMISTRY

CH - 352 : Organic Stereochemistry

(2008 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicates full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

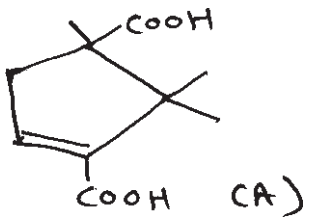
Q1) Answer any four of the following : **[16]**

a) Which conformation of 1,2,2,6,6-penta methyl-4-hydroxyl-4-phenyl piperidine is more stable. Why?

b) Trans 9-methyl decalin is more stable than its cis isomer by 3.35 kJ/mol. Explain.

c) Draw the stereo structures of most stable and least stable conformation of perhydroanthracene. Give nomenclature of these isomers.

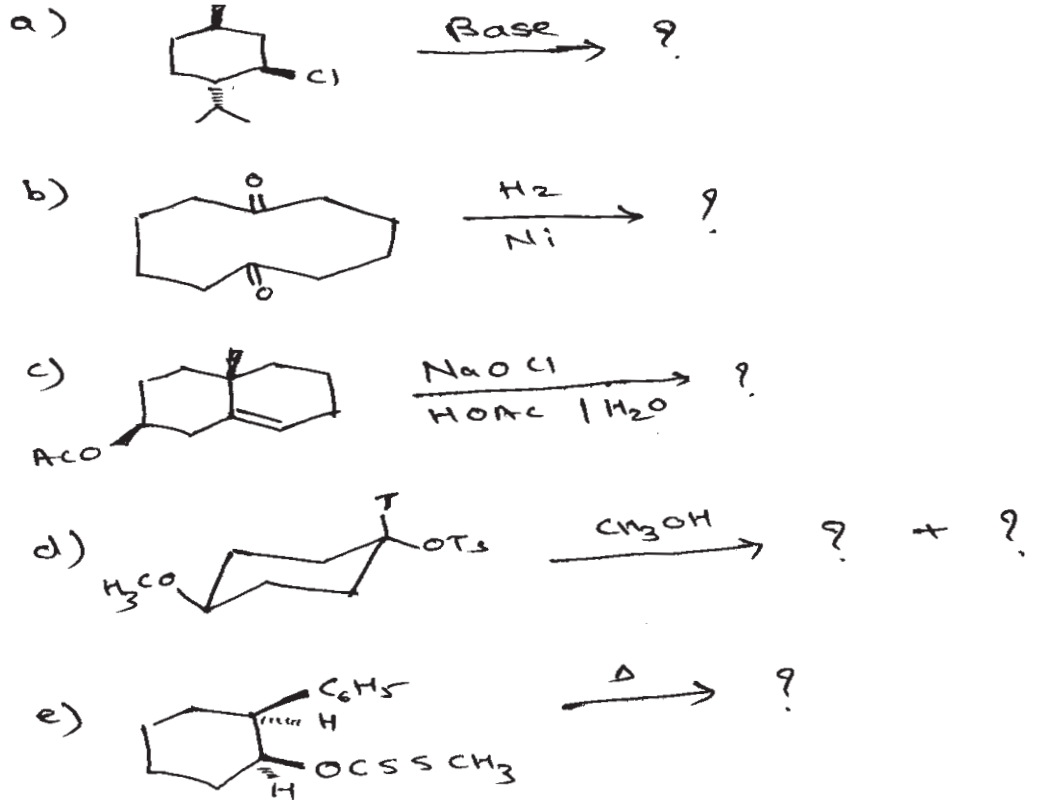
d) Compound (A) do not form anhydride on normal dehydration, where as under vigourous condition, it forms anhydride with difference in structure. Explain why?



e) Explain the concept of I strain with suitable examples.

P.T.O.

Q2) Predict the product in <u>any four</u> of the following and explain stereo chemical principles involved. Justify. **[12]**



Q3) Answer <u>any three</u> of the following : **[12]**

a) Van Arkel rule.

b) Explain Vorit Hoff's rule of optical superposition.

c) Write short note on properties of racemic modifications.

d) Explain few reactions with examples involving formation of racemic products.

SECTION - II

Q4) Answer <u>any three</u> of the following : **[12]**

a) Give the reaction of diazomethane with enhydrin. How this reaction help to deduce the lactone ring fusion with enhydrin.

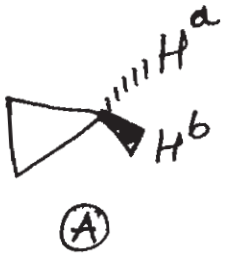
b) Give the evidence to prove that C_3-Vinyl and C_8–C_9 bonds are on the same side in cinchonine and in quinine.

c) Explain the stereo chemistry of C_6–OH and C_{13} – C_{15} bond in codeine and in isocodeine.

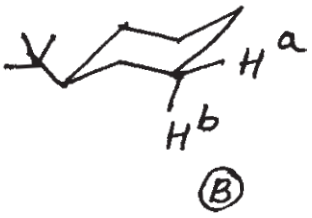
d) Explain the stereo chemistry of C_6 and C_{13} in dihydroiso codeine.

Q5) Answer <u>any four</u> of the following : **[12]**

a) In the following structures, state with reasons, whether the hydrogen marked H^a and H^b are homotopic, enantiotopic or diastereotopic.



(A)



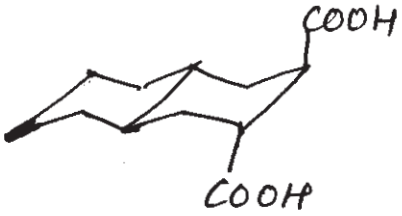
(B)

b) Which of the following compounds are chiral. Explain with reason.

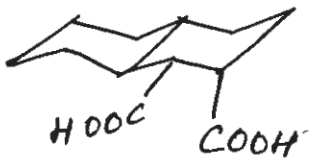
i) trans-cyclo pentane 1,2 dicarboxylic acid.

ii) cis-cyclopentane 1,2 dicarboxylic acid.

c) What is the stereo chemical relationship between the carboxylic acid group in the following compounds? Would it be possible to make an unhydride from these compounds.

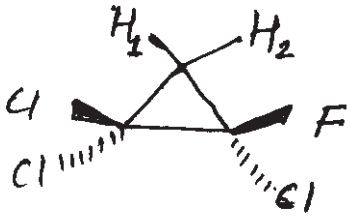


(A)

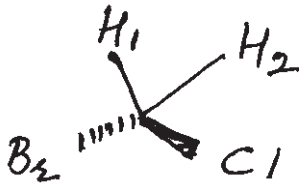


(B)

d) Identify pro-R and pro-S hydrogen atom in the compound I and II.



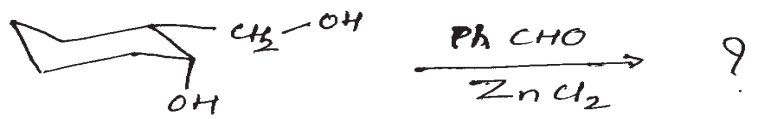
(I)



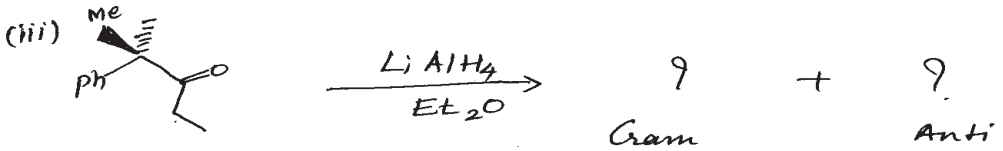
(II)

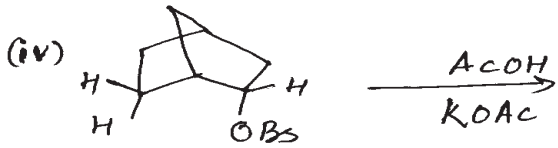
e) Write a note on “Chiral auxillary”.

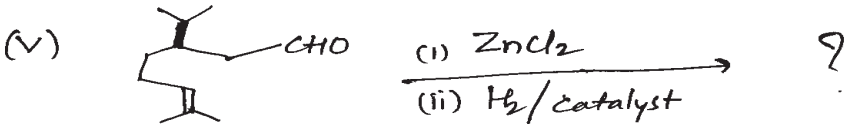
Q6) a) Predict the product/s in the following reactions. Explain the stereo chemistry and mechanism in details (any four) : **[8]**

(i) 

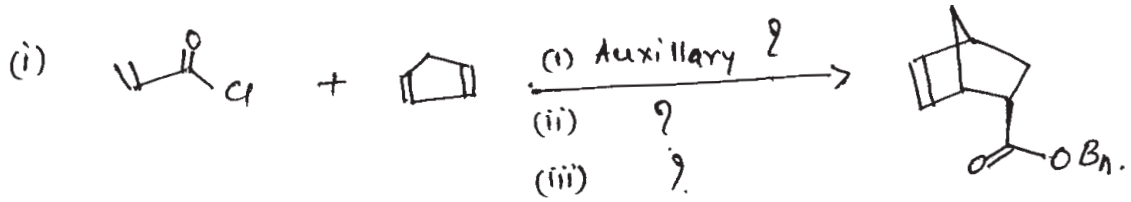
(ii) 

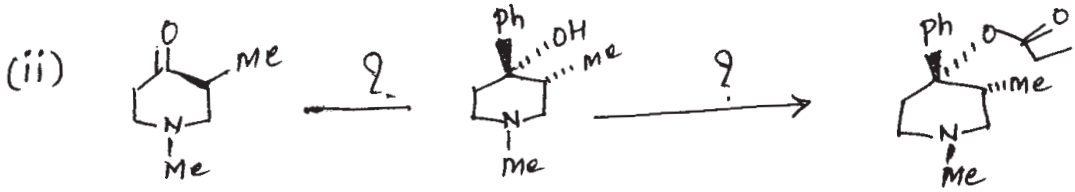
(iii) 

(iv) 

(v) 

b) Suggest the reagent and stereochemistry of the following reactions (any two) : **[8]**

(i) 

(ii) 

(iii) 

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Total No. of Questions : 6]

SEAT No. :

P412

[Total No. of Pages : 4

[4225] - 313
M.Sc. - II
ORGANIC CHEMISTRY
CH - 353 : Free Radicals, Photochemistry and Pericyclic Reactions and Their Applications
(2008 Pattern) (Sem. - III)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) a) Write short notes on <u>any two</u> of the following : **[8]**

i) Autoxidations.

ii) Photoenolisation.

iii) Paterno-Buchii reaction.

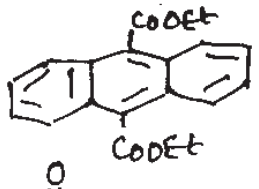
b) Explain <u>any two</u> of the following : **[6]**

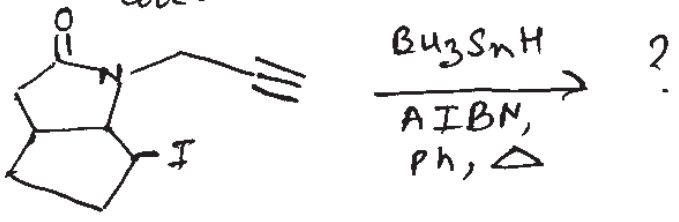
i) Cyclobutanone undergoes three types of photo reactions.

ii) Cyclohexene reacts with dinitrogen tetroxide to form two products.

iii) Free radical chlorination of either n-propyl or isopropyl bromide gives 1-broms-2-chloropropane and of either isobutyl or tertiary butyl bromide gives 1-bromo-2-chloro-2-methyl propane.

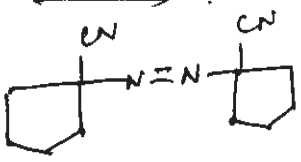
Q2) Predict the product/s indicating mechanism in <u>any four</u> of the following : **[12]**

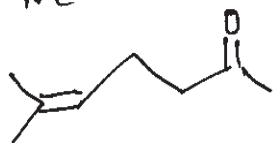
i) 

ii) 

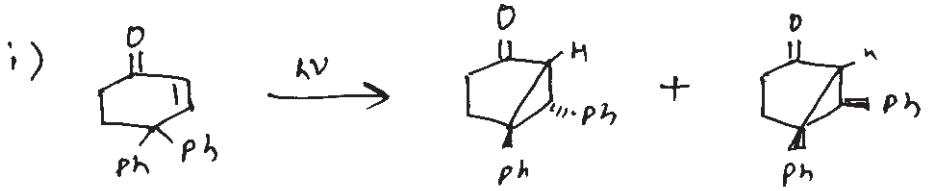
P.T.O.

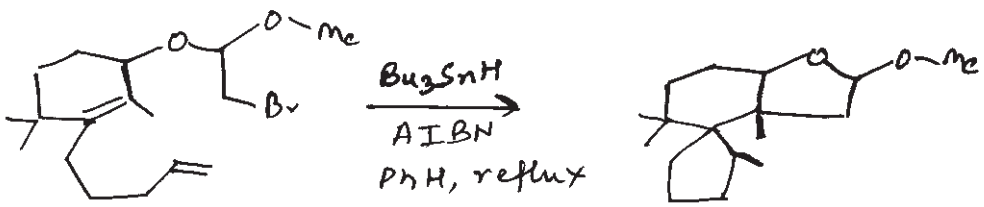
iii) $CCl_4 + CH_2N_2$ (excess) $\xrightarrow{h\nu}$?

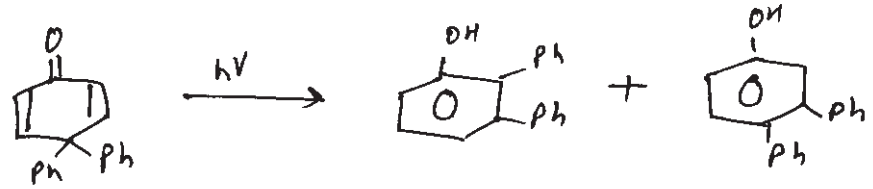
iv) $Me_2C(CN)-N=N-CMe_2(CN)$ +  $\xrightarrow[80°C]{\text{Toluene}}$? + ? + ?

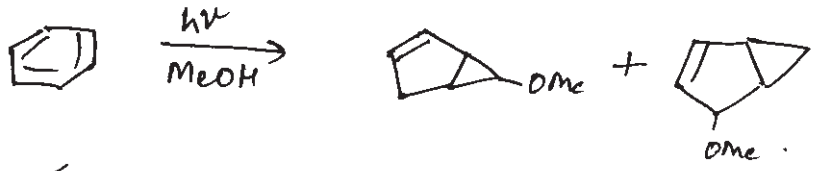
v)  $\xrightarrow{h\nu}$?

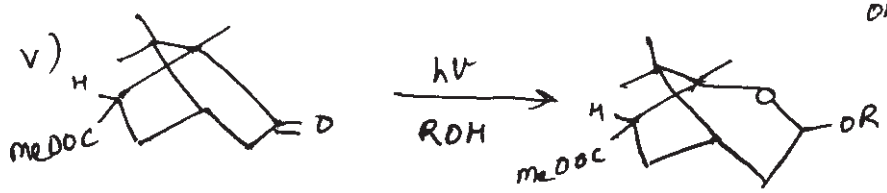
Q3) a) Suggest suitable mechanism for <u>any five</u> of the following : **[10]**

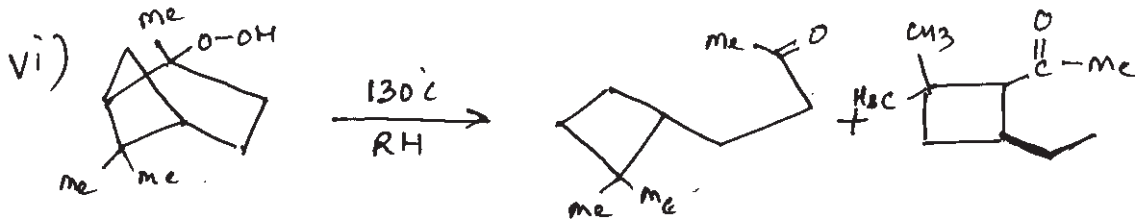
i) 

ii) 

iii) 

iv) 

v) 

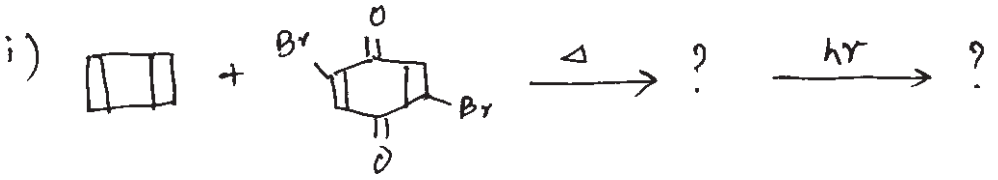
vi) 

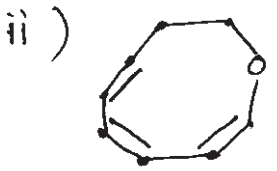
b) Draw energy level diagram and summarise the different photo chemical processes. **[4]**

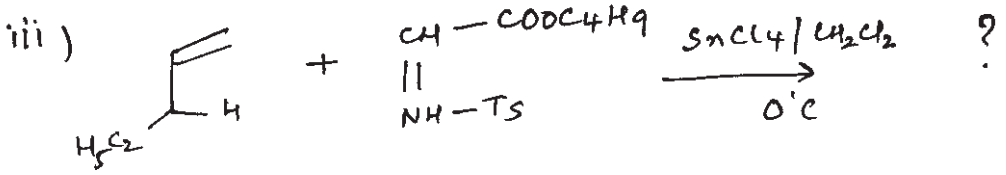
SECTION - II

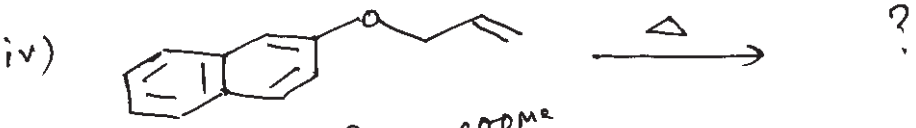
Q4) a) Construct the correlation diagram for $\pi^2_s + \pi^2_s$ cycloaddition reaction and predict whether it is thermally allowed or photo chemically allowed. **[6]**

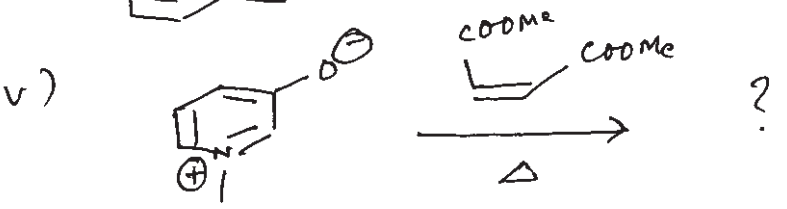
b) Predict the products in <u>any four</u> of the following. Explain their stereochemistry and mechanism. **[8]**





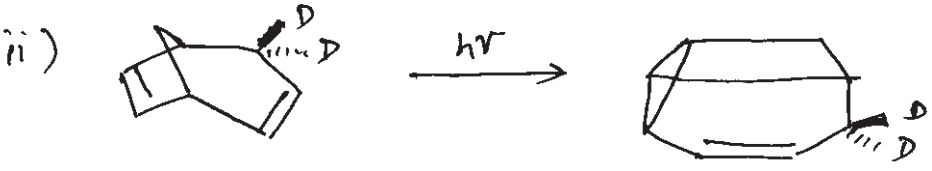


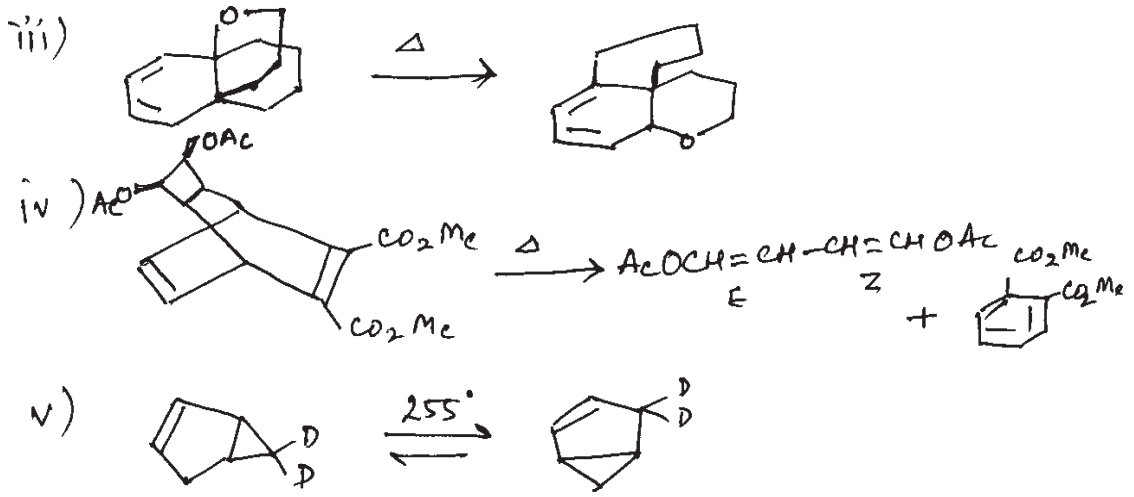




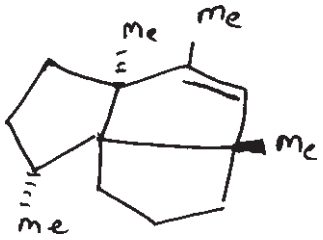
Q5) a) Using FMO approach predict whether a [1, 5] antarafacial sigmatropic carbon shift with retention at the migrating centre is thermally allowed or photo chemically allowed. **[4]**

b) Explain mechanism for <u>any four</u> of the following : **[8]**

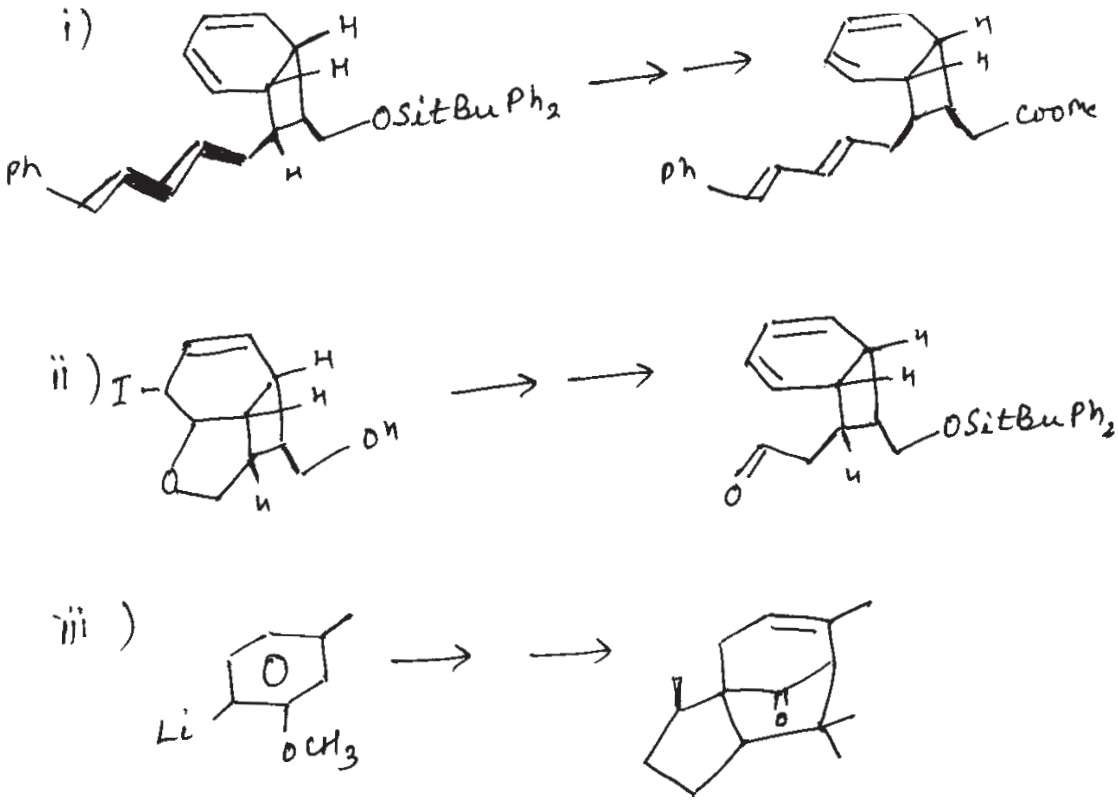




Q6) a) Explain the retro synthetic analysis of Isocomene. **[6]**



b) Complete <u>any two</u> synthetic sequences mentioning reagents and intermediates formed in steps. **[8]**



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Total No. of Questions : 4]

SEAT No. :

P413

[Total No. of Pages : 3

[4225]-314

M.Sc. - II

ANALYTICAL CHEMISTRY

CH-390: Electro Analytical and Current Analytical methods in Industries (2008 Pattern) (Semester - III)

Time :3 Hours] *[Max. Marks :80*

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory and carry equal marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic table/calculator (non-programmable) is allowed.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Discuss briefly factors affecting the limiting current in polarography.

b) Distinguish between differential pulse polarography and square-wave polarography.

c) Describe the electrogravimetric method for estimation of copper from brass.

d) Coulometric titration of iodine with 20 cm^3 of thiosulphate, 25 minutes were required to oxidise thiosulphate and 200 mA of current was used. Calculate the molarity of thiosulphate solution.

e) Reduction of 4.20 mM nitrate to nitrite in dimethyl formamide at 25ºC was studied by polarographic analysis. The drop time was measured at the rate of 3.49 s/drop, the mercury flow rate was 1.86 mg/s and the diffusion current was 14.25 μA. Calculate diffusion coefficient of electroactive species.

Q2) Attempt any four of the following : **[20]**

a) What is meant by stripping voltammetry? Explain anodic and cathodic stripping voltammetry.

P.T.O.

b) Explain the technique of constant current coulometry with examples. Give it's advantages.

c) State principle of amperometry. Describe the nature of amperometric titration curve of lead nitrate with potassium dichromate.

d) What is nanotechnology? Enlist the various methods for synthesis of nanomaterials.

e) An electroactive species yielded a wave with a limiting current 12.5 μA at on rotated disk electrode, which was rotated at 12.0 rotation per sec. Predict the limiting current that would be expected at 24.0 rotation per sec.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) State the principle of neutron activation analysis. Describe the comparator method and give it's merits over absolute method.

b) Discuss principle and technique of radio-reagent method of analysis. State it's limitations.

c) Discuss the principle of direct isotope dilution analysis with suitable example.

d) A 1.0 g of an unknown steel sample and 0.95 g sample of a standard steel known to contain 0.463% Mn, are irradiated with neutrons in a nuclear reactor for 10 hrs. After 40 min cooling period, the activities for gamma-ray emission were found to be 2542 cpm for the unknown and 1984 cpm for the standard. What is the % Mn in the unknown steel sample?

e) The concentration of insulin in a production vat was determined by the method of isotope dilution. 10 mg sample of insulin labelled with ^{14}C, with an activity of 5449 cpm, was added to 10 ml sample. After thorough mixing, a portion of the insulin was separated and purified. 18.3 mg of isolated insulin gave an activity 1248 cpm. Calculate the amount of insulin in the original sample.

Q4) Attempt any four of the following : **[20]**

a) Discuss any two applications of TGA. What are the limitations of TGA technique compared to other thermal methods?

b) Give the criteria to prefer turbidimetry or nephelometry as an analytical tool. Distinguish between nephelometry and turbidimetry.

c) Explain the principle of spectro-electro chemistry and give its applications.

d) Discuss with suitable examples, the effect of particle size of sample, heating rate and furnace atmosphere on the thermogram.

e) A mixture of CaO and $CaCO_3$ was analysed by TGA. Result indicates that mass of sample decreases from 250.6 mg to 190.8 mg between 600ºC to 900ºC. Calculate the percentage of $CaCO_3$ in the mixture. [At. wt. of Ca = 40.1, C = 12, O = 16].

Total No. of Questions : 4]

SEAT No. : ____

P414

[Total No. of Pages : 3

[4225]-315

M.Sc. - II

ANALYTICAL CHEMISTRY

CH-391: Environmental and Analysis of Industrial Materials

(2008 Pattern) (Semester - III)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory and carry equal marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables, non-programmable calculators is allowed.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Describe a method used for estimation of nitrogen from sample of urea.

b) Enlist the major and minor constituents of glass. Outline the procedure for estimation of sodium from the glass sample.

c) Discuss the method to extract and estimate unsulphonated and unsulphated material from sample of detergent.

d) Explain the procedure for estimation of Zinc by using 8-hydroxyquinoline from deodorants and antiperspirants.

e) 0.555 gm of nitrogen fertilizer was kjeldahlized and NH_3 produced was absorbed in 50 ml N/10 H_2SO_4. The excess of acid required 19 ml of N/10 NaOH solution for neutralization. Find the percentage of nitrogen in the fertilizer. [Given At.wt N = 14].

Q2) Attempt any four of the following : **[20]**

a) Define the terms :

i) Pigment
ii) Binder
iii) Vehicle
iv) Varnish
v) Flash point.

b) What are propellants and explosives? Explain adiabatic calorimeter method to measure heat of explosion.

P.T.O.

c) Discuss the role of Thinner, Binder and Pigment in paints.

d) 0.633 gm sample containing MnO_2 was treated with con.HCl liberating Cl_2. Then Cl_2 was passed into a solution of KI and 33.33 ml of 0.1108 M $Na_2S_2O_3$ is required to titrate the liberated I_2. Calculate the percentage of MnO_2 in the sample.
[At.wt. I = 127, Mn = 53.93, O = 16]

e) 0.66 gm sample of ilmenite was fused with Potassium persulphate and the mass was extracted with H_2SO_4 solution. After removal of insoluble matter, the filtrate was diluted to 100 ml. From an aliquot of 50 ml after removal of iron, Ti-cupferron complex was precipitated. After ignition of precipitate, 0.166 gm of titanium oxide was obtained. Calculate the percentage of TiO_2 and Ti in the sample.
[Given At.wts Ti = 47.88, O = 16]

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Explain the method of extraction and estimation of aluminium from bauxite ore.

b) Describe the method for determination of phosphorous from steel.

c) Outline the analytical procedure for the determination of any one of the following :

i) Copper from Brass alloy.
ii) Iron from ilmenite ore.

d) 0.65 gm brass sample was dissolved in acid and the solution is diluted to 250 ml. 50 ml sample solution was taken and copper was precipitated by adding 1% α – benzoin oxime at alkaline condition. After filtration, and drying the precipitate of copper is weighed as $Cu(C_{14}\ H_{17}\ O_2N)$. The weight of precipitate was 0.423 gm. Calculate the percentage of copper in the sample. [Given At.wt Cu = 63.54, C = 12, O = 16, N = 14, H = 1].

e) A waste water sample of 175 ml was refluxed with 25 ml of $K_2Cr_2O_7$ and 25 ml con.H_2SO_4 for two hours. The solution was titrated with FAS and the burette reading was 21.4 ml. A 25 ml aliquot of 0.25 N $K_2Cr_2O_7$ required 24.9 ml of the same FAS. Calculate the chemical oxygen demand (COD) of the waste water.

Q4) Attempt any four of the following : **[20]**

a) What is the significance of BOD? How BOD is estimated?

b) Describe trickling filter process for waste water treatment.

c) Explain the generation of CO_x and its hazardous effects on human health. How is it controlled?

d) Write notes on <u>any one</u> :

i) Estimation of lead from waste water.

ii) Electrostatic precipitator.

e) Describe air pollution caused by suspended particulate matter. How is it controlled?

Total No. of Questions : 4]

SEAT No. : ____

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[Total No. of Pages : 3

[4225]-316

M.Sc. - II

ANALYTICAL CHEMISTRY

CH-392: Advanced Analytical Techniques

(2008 Pattern) (Semester - III)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory and carry equal marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables/non-programmable calculator is allowed.***
5) ***Use of graph paper is allowed.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) State the Kirchoff's law. State its significance in relation with conservation of mass and energy.

b) Draw the circuit symbols of the following :

i) Photo resistor
ii) Zener diode
iii) Photo diode
iv) P-n junction diode
v) Light emitting diode

c) Write a critical note on continuous flow analyzers.

d) Explain the scope of the microprocessor control of AAS in analytical laboratories.

e) How much time is required when 0.240 A current flow in order to plate 0.525 gm of Cu from Cu (II) sulphate solution?
Given : At mass of Cu – 63.54 gm/mole.
Faradays const. (F) – 96,487 c/mole.

Q2) Attempt any four of the following : **[20]**

a) Explain the difference between metallic conductors, insulators, and semiconductors on the basis of band theory.

P.T.O.

b) Draw the outline of the microprocessor control in Atomic Absorption Spectrophotometer.

c) Draw the circuit diagram showing forward and reverse biasing of p-n junction.

d) Convert 18 & 23 into binary equivalents and add the binary numbers. Convert the answer to a decimal number.

e) Calculate the applied voltage of transformer with turn ratio 8:1 when voltage of 230V is applied to the primary coil.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Explain the following terms with respect to A.A.S.

i) Sputtering
ii) Releasing agent
iii) Spectral interference and it's correction method.

b) Write a note on Atomic fluorescence spectroscopy.

c) Compare the flame emission and atomic absorption spectroscopic techniques of analysis with respect to principle and method of analysis.

d) Mention the elements required as micro-nutrients for the growth of crop. Describe any one suitable method for determination of Molybdenum from soil sample.

e) Magnesium in blood serum can be determined by AAS. As 10 ml of serum sample is diluted to 100 ml and it's absorbance is 0.250. A standard solution containing 2.0×10^{-5} moles of Mg^{2+} gives an absorbance 0.187. Calculate the Magnesium concentration in the blood serum sample in percent. Given Atomic mass g mol^{-1} Mg = 24.

Q4) Attempt any four of the following : **[20]**

a) Give a brief account of radioimmuno assay with special reference to principle and application.

b) Compare supercritical fluid with gas and liquid, also compare supercritical fluid chromatography with other column chromatography techniques.

c) Explain 'ELISA' with respect to principle, practical aspects and applications.

d) Explain the working of Hollow Cathode lamp.

e) Chromium in an aqueous sample was determined by pipetting 10 ml of unknown solution, into each five 50 ml volumetric flasks containing various volumes of standard solution of 12.5 ppm of Cr from the following data calculate ppm of Chromium sample.

Unknown sample (ml)	Standard (ml) Vs	Absorbance A
10	0.0	0.201
10	10	0.202
10	20	0.378
10	30	0.467
10	40	0.554

Total No. of Questions : 4]

SEAT No. : ____

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[Total No. of Pages : 2

[4225]-317

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 380: Pharmaceutical Analysis

(2008 Pattern) (Sem. - III)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Use of logarithmic table/non-programmable calculator is allowed.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Discuss "Impurities" commonly associated with pharmaceutical chemicals.

b) Give the method used for determination of expiry date for formulated product.

c) Explain precession of Biological assay.

d) What are limit tests? Discuss limit test for chloride and sulphate.

e) Discuss dissolution test for capsules.

Q2) Attempt any four of the following : **[20]**

a) Give the procedure for preparation and standardization of K.F. reagent.

b) How water soluble ash from vegetable drug is determined?

c) Explain 'Sterility test'.

d) How thiomersal is determined?

e) Explain in detail cup - plate method used in microbial assay.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Differentiate between Ointments and Creams.

b) Explain detail procedure used for determination of Sodium benzoate from drug sample.

P.T.O.

c) State the precautions taken during manufacture of Opthalmic preparations.

d) Write a note on F.D.A.

e) 0.325 g of phenobarbitone ($C_{12}H_{12}N_2O_3$) was dissolved in 40 ml DMF and was titrated with 0.1 N Lithium methoxide using quinoldine red indicator. The titration reading was 9.7 ml. Calculate the percentage of phenobarbitone in given sample.
[Given: At.wt : C = 12, H = 1, N = 14, O = 16]

Q4) Attempt <u>any four</u> of the following : **[20]**

a) Give the advantages of aerosols.

b) What are binders? Explain role of binder in tablets.

c) What are suspensions? Give the method used for the preparation of suspensions.

d) Give in detail "assay of salicylic acid".

e) 40 ml sample of saline was diluted to 100 ml with distilled water. 25 ml of this diluted solution was titrated with 0.05 N silver nitrate using Potassium chromate as an indicator. The burette reading was 11.5 ml. Calculate the amount of Sodium chloride present in given sample.
[Given: At.wt. : Na = 23, Cl = 35.5]

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Total No. of Questions : 4]

SEAT No. : ____

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[Total No. of Pages : 2

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M.Sc. - II

ANALYTICAL CHEMISTRY

CH-381: Medicinal Chemistry

(2008 Pattern) (Semester - III)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory and carry equal marks.***
3) ***Neat diagrams must be drawn wherever necessary.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Write a short note on biological assay.

b) Give the different theories of drug activity explaining any one in detail.

c) Discuss the relationship between Free-Wilson and Hansch-analysis.

d) Define and explain :

i) Soft-drug
ii) Drug receptors
iii) ED 50
iv) Isosterism

e) Enlist the uses of pharma cokinetics in drug development process.

Q2) Answer any four of the following : **[20]**

a) Explain the different aspects of chemical assay of drugs using wet methods.

b) Write a short note on 'Novel Drug Delivery System'.

c) Write a brief account of different physico-chemical parameters affecting drug action.

d) Describe in short computer aided drug design.

e) Define what is meant by a drug. Give different methods of classification of drugs.

P.T.O.

SECTION - II

Q3) Answer any four of the following : **[20]**

a) Explain the mode of action of the following types of drugs with suitable examples :

i) Neuroleptics
ii) Anti-depressants

b) Discuss the synthesis of any one cardio-vascular drug.

c) What are sedatives and hypnotics? Give their classification.

d) Give the synthesis of the following drugs :

i) Chlorazepam
ii) Penicillin G.

e) What are local anti-fective drugs? Discuss their mode of action with suitable examples.

Q4) Answer any four of the following : **[20]**

a) Define the terms :

i) Neuro transmitters.
ii) Mitotic inhibitors.
iii) Carcinolytic antibiotics.

b) Discuss the role of alkylating agents and antimetabolites in treatment of cancer.

c) Give the role of Hormones and natural products in chemotherapy.

d) Write a short note on 'Psychoactive drugs'.

e) Explain the mode of action of Quinolan antibacterial.

Total No. of Questions : 6] **SEAT No. :**

P418 **[Total No. of Pages : 3**

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M.Sc.

PHYSICAL CHEMISTRY

CH - 410: Molecular Structure and Spectroscopy

(2008 Pattern) (Semester - IV)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of logarithmic tables/calculator is allowed.***

Physico - Chemical Constants

1.	Avogadro Number	N	=	6.022×10^{23} mol^{-1}
2.	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} molecule^{-1}
			=	1.38×10^{-23} J K^{-1} molecule^{-1}
3.	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Discuss in brief the quantum mechanical approach of NMR spectroscopy theory.

b) State the essential characteristics of the instrumentation for high resolution NMR.

c) Define the following terms in NMR spectroscopy

i) Chemical shift
ii) Nuclear spin
iii) Nuclear resonance
iv) Saturation

d) Distinguish between 'CMR' and 'NMR' spectroscopy.

e) Explain the concept of 'electric field gradient' and quadrupole coupling constant.

Q2) Answer any three of the following : **[15]**

a) Explain the principle of ESR. Why does the source have to be from the microwave region for observing ESR?

b) Why is ESR spectrum recorded in the first derivative mode?

c) How many ESR lines are expected in the ESR spectrum of a anthracene anion? Explain.

d) Explain the terms: Spin polarization, unpaired spin density and hyperfine coupling constant in ESR spectra.

e) With the help of a schematic diagram, explain the working of photo acoustic spectrometer.

Q3) Solve any two of the following : **[10]**

a) Calculate the magnetic field that produces resonance condition for a sample with g-value 2.8 in an ESR spectrometer using 30 mm radiation. (Given : $\mu_e = 9.274 \times 10^{-24}\ JT^{-1}$).

b) With a brief explanation, draw the schematic high resolution ESR spectra of the following species.

i) Methyl radical
ii) Benzene anion.

c) Calculate the frequency separation of nuclear spin states in ^{13}C nucleus with a magnetic field of 14.5T, the magnetogyric ratio being $6.73 \times 10^7\ T^{-1}S^{-1}$.

SECTION - II

Q4) Answer any three of the following : **[15]**

a) State and explain the X-ray diffraction and interference of wave motions.

b) Give a brief account of the Bragg method of crystal structure analysis.

c) Draw a neat labelled diagram of an X-ray powder camera. Show that for a powder camera of radius 57.296 mm, 1° is equal to 1 mm.

d) Give the remarkable differences between X-ray and electron diffraction techniques.

e) Write an account of diffraction of electrons by gases with reference to Wierl equation.

Q5) Answer any three of the following : **[15]**

a) Discuss the applications of electron diffraction technique.

b) Discuss the advantages of X-ray diffraction technique over neutron diffraction technique.

c) Explain the terms magnetic susceptibility per unit volume, the atomic susceptibility and the molar susceptibility.

d) What are paramagnetic, diamagnetic and ferromagnetic substances? Explain the origin of ferromagnetism.

e) Explain the working of non-uniform field method. What are the advantages of non-uniform field method over uniform field method.

Q6) Answer any two of the following : **[10]**

a) X-ray diffraction of crystals yields the cubic unit cell length as 0.408 nm. The density of crystal is 19.30 gcm^{-3}. Calculate the number of atoms in the cubic unit cell of the crystal.

[Given : atomic weight of the crystal = 196.967]

b) Calculate the volume and mass paramagnetic susceptibilities of a sample of a complex salt with three unpaired electrons at 25°C.

[Given : density = 1.85 gcm^{-3}, molar mass = 228 $gmol^{-1}$]

c) Using Pascal constants and appropriate constitutive corrections given below, calculate the molar susceptibility of benzoic acid.

[Given : Pascal constants in cgs units:

$C = -6.0 \times 10^{-6}$, $H = -2.93 \times 10^{-6}$

O_2 (carboxylate) $= -7.95 \times 10^{-6}$

Constitutive Corrections in cgs units

C (in ring) $= -0.24 \times 10^{-6}$]

Total No. of Questions : 6] **SEAT No. :**

P419 **[Total No. of Pages : 3**

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M.Sc.

PHYSICAL CHEMISTRY

CH-411: Surface and Electrochemistry

(2008 Pattern) (Semester - IV)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicates full marks. .***
5) ***Use of logarithmic table/calculator is allowed.***

Physico - Chemical Constants

1.	Avogadro Number	N	=	6.022×10^{23} mol^{-1}
2.	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} molecule^{-1}
			=	1.38×10^{-23} J K^{-1} molecule^{-1}
3.	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Derive Gibb's equation for adsorption at liquid surface.

b) Explain the term detergency and explain briefly factors involved in detergent action.

c) Distinguish between physical adsorption and chemisorption.

d) Describe any one experimental method for measurement of adsorption of gas on solid.

e) Derive the equation for Longmuir adsorption isotherm.

Q2) Attempt any three of the following : **[15]**

a) Write the BET equation and explain the terms involved it. How it is used for determination of specific surface area of solids?

b) What is capillary condensation? Explain briefly the phenomena of hysteresis observed in capillary condensation.

c) What is catalyst deactivation? Describe different methods of deactivation.

d) What are Zeolites? Discuss briefly their applications.

e) Explain the terms :

i) Catalyst activity.
ii) Site.
iii) Turn over number.
iv) Functionality.

Q3) Solve any two of the following : **[10]**

a) In adsorption of $H_2(g)$ over a sample of Cu powder 1.36 cm^3 $H_2(g)$ measured at STP was found to adsorb per gram Cu powder. Considering only monolayer adsorption, determine specific surface area of copper. Density of liquid H_2 is 0.07 glcc.

b) Using Vant-Hoff type equation, calculate the enthalpy of adsorption, when at 1 atm. 155 cm^3 of gas (measured at STP) is adsorbed by one gram charcoal at 88 K and 15 cm^3 at 273 K.

c) Surface tension of propanol-water mixture follows the equation $\gamma = 70 - 0.5C + 0.19C^2$, where C is propanol concentration in moles/lit. Calculate surface excess concentration (Γ) in moles cm^{-2} for 0.2 m solution at 300K.

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) Explain briefly the steps in Eley and Evans thought experiments for evaluation of heat of solvation in ion-dipole model.

b) What is thickness of ionic atmosphere? Write the equation for it and explain how it varies with concentration of ion, valency of ion and temperature of solution.

c) Derive the Einstein relation between absolute mobility and diffusion coefficient.

d) Describe Gouy-Chapman model for electrical double layer.

e) Derive Tafel equation from Butter-Volmer equation.

Q5) Attempt any three of the following : **[15]**

a) Describe briefly local-cell theory for corrosion.

b) Explain the terms :

i) Surface potential.
ii) Outer potential.
iii) Inner potential.
iv) Electro chemical potential.

c) Describe with a neat diagram $H_2 - O_2$ fuel cell.

d) Enlist the desirable trends in order to maximise the energy density and power out put in a cell for producing electrical energy.

e) Discuss the factors affecting the electrolytic redox reactions in electrosynthesis.

Q6) Solve any two of the following : **[10]**

a) The diffusion coefficient of K^+ and Cl^- in a dilute solution at 300 K were measured as 9.5×10^{-5} cm^2s^{-1} and 2.5×10^{-5} cm^2s^{-1} respectively. Calculate the equivalent conductance of dilute KCl solution at 300 K.

b) 300 ml 0.1 m Na_3PO_4 is mixed with 100 ml 0.2 m $ZnCl_2$ and 100 ml 0.05 m $CaSO_4$. Calculate the ionic strength of solution assuming complete dissociation.

c) Calculate the electricity storage density and energy density for copper electrode whose reversible electrode potential ($Cu^{++} + 2e \rightleftharpoons Cu$) is 0.34 V. Atomic mass of Cu is 63.55.

Total No. of Questions : 4] **SEAT No. :**

P420 **[Total No. of Pages : 3**

[4225]-403

M.Sc.

PHYSICAL CHEMISTRY

CH - 414: Biophysical Chemistry and Related Techniques

(2008 Pattern) (Semester - IV)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***Answers to the TWO sections should be written in SEPARATE answer books.***
2) ***All questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate full marks.***
4) ***Use of logarithmic table/calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

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			=	6.626×10^{-34} J s
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5.	1 eV		=	23.06 k cal mol^{-1}
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			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Attempt <u>any four</u> of the following : **[20]**

a) Discuss the differences between plant & animal cells.

b) Define contour length of a macromolecule. Write expressions for R_{mp}, R_g, R_{rms} explaining the terms.

c) What are flickering clusters? Explain the directionality of the H bond.

d) Explain the tests for proteins. What are Chaperones?

e) Deduce the Henderson-Hassalbalch equation. What is the pH of blood in a healthy human?

f) Write a note on blood buffering system.

Q2) Attempt <u>any four</u> of the following : **[20]**

a) What is Needham concept? Explain the different levels of biological structure.

b) Explain the unusual nature of proline as an amino acid.

c) Write a note on proteolysis.

d) Explain the use of electronic osmometer to determine osmotic pressure.

e) Explain why the phosphoanhydride bond is called a high energy bond.

f) What is premordial soap? Explain the applications of Donnan Membrane Phenomenon.

SECTION - II

Q3) Attempt <u>any four</u> of the following : **[20]**

a) What is passive transport? How is it facilitated by membrane proteins?

b) Explain reversible enzyme inhibition with examples.

c) Describe with a neat diagram the fluid mosaic model to explain the structure of cell membrane.

d) Define the terms :

i) Endocytosis
ii) Antiport
iii) Axolemma
iv) Synapse and
v) Afferent nerves

e) Write a note on Oscillating chemical reactions.

f) Explain the terms :

i) Gel electrophoresis and

ii) Solubilizers.

Q4) Attempt <u>any four</u> of the following : **[20]**

a) Discuss briefly the methods by which the size of biopolymer particles is determined.

b) What is flow birefringence? How is the molecular weight of a biopolymer determined by flow birefringence?

c) Describe the sedimentation velocity method to determine the molecular weight of biopolymers.

d) Describe the instrumentation used for measuring optical rotatory dispersion.

e) Discuss the biological significance of Donnan membrane equilibrium.

f) Write a note on Helix-cell transition.

Total No. of Questions : 5] **SEAT No. :**

P421 **[Total No. of Pages : 3**

[4225]-404

M.Sc.

PHYSICAL CHEMISTRY

CH-415: Special Topics in Nuclear Radiation Chemistry

(Semester - IV) (2008 Pattern)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***Answers to the TWO sections should be written in SEPARATE answer books.***
2) ***All questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate full marks.***
4) ***Use of logarithmic tables/calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

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			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Write a note of technetium generator.

b) Discuss the principle of Radio-immuno assay. With suitable example explain how is it used in diagnosis of a disease.

c) Which radiation sources are used for food irradiation? Draw and explain the symbol of food irradiation.

d) What you understand by the term radiopharmaceutical. Explain the mechanism by which it treats a particular disease.

e) Discuss the principles of separation of isotopes. How gas diffusion method is useful in the separation of isotopes?

Q2) Attempt any three of the following : **[15]**

a) Discuss the properties of plank era, Inflation era and Electroweak era.

b) Write a note on C-N-O bicycle.

c) Give classification of meteorites.

d) Write a note on intermediate level radioactive liquid waste management.

e) Which precautions are to be taken while handling radioactive waste.

Q3) Attempt any two of the following : **[10]**

a) Write down the PPI and PPII reactions.

b) Activity of ^{99m}TC extracted after 6 hours of loading of $^{99}M_0$ in the generator was found to be 12,000 cpm. Find out activity of loaded $^{99}M_0$. Given $t_{1/2}$ of $^{99}M_0$ = 66h & ^{99m} Tc = 6.01h

c) Find out the dose due to 300 mci of ^{60}Co at a distance of 3 meters. Given: Γ Energy of ^{60}Co = 1170 and 1330 keV.

SECTION - II

Q4) Answer any four of the following : **[20]**

a) Describe the phenomenon of radiolysis of benzene.

b) Write all possible radiolysis reactions for organic compounds.

c) Discuss the problems observed in the preparation of target by reactor irradiation.

d) Give an account of choice of counting method for the measurement of activity of samples.

e) What is the necessity of thin targets? How are they prepared?

f) Discuss how kinetic equations are applied to deduce reactant concentration in a reaction using various techniques.

Q5) Attempt <u>any four</u> of the following : **[20]**

a) Explain molecular kinetics on the basis of Arrhenius law.

b) Define a chain reaction. Discuss its types.

c) With a neat labelled diagram explain the experiment used to study the radiometric titration.

d) Draw and describe the radiometric titration curve for the mixture of two ions in which ion precipitating last is labelled.

e) Give an account of radiometric titrations based on absorption of β-particles. What are its advantages?

f) 20cc of zinc ions labelled with $^{65}Z_n$ were titrated with 0.001M dithiozone. Addition of 2cc of titrant followed by extraction of complex showed a drop in activity from 10,200 for 5 min to 1700 counts per min. Calculate the concentration of zinc ions in terms of molarity.

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Total No. of Questions : 4]

SEAT No. :

P422

[Total No. of Pages : 2

[4225]-405

M.Sc. - II

INORGANIC CHEMISTRY

CH-430: Inorganic Solids and Heterogenetics Catalysis

(2008 Pattern) (Semester - IV)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagrams wherever necessary.***

Q1) Answer the following (any 4) : **[20]**

a) Explain in detail Heteropolyanious of Molybdenum and tungsten.

b) Write an account on Molecular sieves.

c) What are the special properties of supported metal catalysts? How are these modified by promoters and poisons?

d) Which type of reactions are catalysed by semiconducting oxides? Explain in detail one reaction catalysed by these oxides.

e) What are catalytic reactors? Name the different reactors and explain working of any one of them.

Q2) Attempt any four : **[20]**

a) What is meant by phase transfer catalyst? Describe one reaction catalysed by this type of catalyst.

b) Explain the techniques used for characterization of a zeolitic material.

c) Find out the frame work electrons in $Ir_4(CO)_{12}$ and predict its structure.

d) List the different methods of preparation of heterogeneous catalysts and explain one in detail.

e) Give an account of the surface characterization methods for supported metal catalysts.

P.T.O.

Q3) Attempt <u>any four</u> : **[20]**

a) Match the following :

	A	B
i)	Al_2O_3	Polymerization
ii)	H_3PO_4	dehydration
iii)	ZnO	P-type semiconductor
iv)	Ni O	Zeolite
v)	Mordenite	n type semiconductor

b) Explain the importance of nanomaterials as catalysts.

c) Silicon forms a number of polyoxoanions but not carbon. Why? Draw the structures of polyoxoanions of silicon.

d) Give the reactions for synthesis of high nuclearity metal clusters.

e) Explain what is meant by peroxyacids and explain acidic properties.

Q4) Write notes on (any 4) : **[20]**

a) ZSM-5 Zeolite.

b) Adsorption isotherms and catalysis.

c) Electro catalysis.

d) Cyclic polymers.

e) Catalysis in petro chemical industry.

Total No. of Questions : 4]

SEAT No. : ____

P423

[Total No. of Pages : 2

[4225]-406

M.Sc. - II

INORGANIC CHEMISTRY

CH - 431: Material Science

(Semester - IV) (2008 Pattern)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic table/calculator is allowed.***

Q1) Attempt any FOUR of the following : **[20]**

a) What is nano - particle? What is meant by quantum well, quantum wire and quantum dot.

b) What is a semiconductor? Explain the types of semiconductors.

c) What are Biomaterials? Give the classification of biomaterials.

d) Give the important stages of sol - gel process.

e) Explain the Peltier and seeback effect of two disimilar metals.

Q2) Attempt any FOUR of the following : **[20]**

a) Draw the schematic flow diagram of cement making process. How is the quality of cement improved?

b) What is LASER? Explain the Ge - As LASER.

c) Discuss the working of n - p junction.

d) Explain photoconductivity with the help of band energy diagram.

e) What is Asphalt? What is the chemical composition of Asphalt? Explain its applications.

Q3) Attempt any FOUR of the following : **[20]**

a) Derive the expression $\chi = \frac{C}{T - \theta}$.

b) Determine the mobility of electron in copper assuming that each atom contributes to free electron for conduction.

P.T.O.

Given :- Resistivity $\rho = 1.7 \times 10^{-6} \Omega / cm.$
Density = 8.99 gm/cc.
At wt = 63.5

c) An n - type semiconductor is to have a resistivity 20Ω/cm. Calculate the number of donor atoms which must be added to achieve this.
Given that μd = 1000 cm^2/v.s

d) Mobilities of electron and holes in a sample of intrinsic germanium at room temp. are 3600 cm^2/v.s and 1700 cm^2/v.s respectively. If the electron and hole densities are each equal to $2.5 \times 10^{13}/cm^3$. Calculate the conductivity.
Data = μe = 3600 cm^2/v.s.
μn = 1700 cm^2/v.s.
ni = ne = nn = $2.5 \times 10^{13}/cm^3$.

e) The saturation magnetisation of FCC and simple cubic iron have 1700 kA/M and 1600 kA/M respectively. Calculate the net magnetic moment per iron in crystal of FCC and simple cubic lattice constant of FCC or simple cubic is 2.87Å and 1 B.M = 9.273×10^{-24} A/m^2.

Q4) Attempt any FOUR of the following : **[20]**

a) Differentiate between Schottky and Frenkel defects.

b) Write a short note on - Bio - solids.

c) Write the applications of nano - materials.

d) What are Hard and soft magnets? Give their applications.

e) Explain the type - I thermal decomposition reaction in solid state.

Total No. of Questions : 9]

SEAT No. :

P424

[Total No. of Pages : 3

[4225]-407

M.Sc. - II

INORGANIC CHEMISTRY

CH-445: Inorganic Applications in Industry, Biotechnology and Environmental Chemistry

(2008 Pattern) (Sem. - IV)

Time :3 Hours] *[Max. Marks :80*

Instructions to the candidates :

1) ***Attempt any two sections from the following.***
2) ***Both sections should be written in the same answer book.***
3) ***All questions are compulsory.***
4) ***Figures to the right indicate full marks.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Use of logarithmic table/calculator is allowed.***

SECTION - I

Inorganic Applications in Industry

Q1) Attempt any three of the following : **[15]**

a) What are formazans? How are they classified as ligands? Give at least two examples of each and draw the structure of metal complexes they form.

b) What is meant by the term pigment? Explain the following properties of inorganic pigments.

i) Colour;
ii) Hiding power;
iii) Ease of wetting and dispersion;
iv) Chemical resistance.

c) Explain the methods for electroplating of precious metals.

d) Explain the production and properties of glass fibers for reinforcing plastic resin.

P.T.O.

Q2) Attempt any three of the following : **[15]**

a) Give in details production of Portland cement.

b) Give two examples and draw structure of -

i) Metallized dyes,
ii) Additional reagents,
iii) Medially metallized azodyes.

c) Explain the microstructure of soft wood.

d) What do you understand by Nα-Nβ isomerisms in metal complexes of azo compounds? Explain with respect to Nickel and Copper complexes.

Q3) Write short notes on any two : **[10]**

a) Alloy plating.

b) Natural earth colour pigment.

c) Carbon Fiber reinforced epoxy resin.

SECTION - II

Environmental Chemistry

Q4) Attempt any three of the following : **[15]**

a) What does primary and secondary treatment in a sewage treatment plant removes from the waste stream?

b) Compare aerobic treatment process with an anaerobic treatment process.

c) Will geothermal energy ever be a major source of energy world wide? Explain.

d) Draw a schematic diagram of an alkaline fuel cell (AFC). Write the reaction that occur at the cathode and anode. Show overall reaction. What is the electrolyte used in the AFC?

Q5) Attempt any three of the following : **[15]**

a) List the five provisions of the clean water Act. Which of these are considered the most important?

b) Define pE. What is the range of pE in natural water? A sample from lake gave a pE = 10.5 does the lake favour oxidation?

c) Name the instrumental methods, for the determination Hg, Cd, As, Pb. Explain cold-vapour Atomic absorption determination of mercury from polluted water.

d) Mercury (Hg^{2+}) has a t½ of 8 days. If a person injects 3 mg/day. Calculate the steady state concentration of mercury.

Q6) Write a notes (any two) : **[10]**

a) Reverse Osmosis.

b) Energy from biomass.

c) Electrodialysis.

SECTION - III

Biotechnology

Q7) Answer any three : **[15]**

a) Biotechnology is a result of research and contribution from various branches of science. Justify.

b) Name the different process used in water treatment and explain the Deep Shaft process in detail.

c) How can fungi be used for production of food?

d) What do you understand by term antibiotics? How are they used to cure diseases?

Q8) Answer any three : **[15]**

a) Explain the use of clones for the synthesis of antigens.

b) Compare and contrast between the suspended growth and supported growth system.

c) What is Sewage? Can Sewage treatment be made effective with the use of microbes and give examples in support of your answer.

d) What are enzymes? What makes them suitable as bio-catalysts? Explain.

Q9) Write short notes on (Any two) : **[10]**

a) Solid state fermentations.

b) Microbes and oil recovery.

c) Stages in Genetic engineering.

Total No. of Questions : 6] **SEAT No. :**

P425 **[Total No. of Pages : 4**

[4225]-408

M.Sc. - II

ORGANIC CHEMISTRY

CH-450 : Chemistry of Natural Products

(2008 Pattern) (Semester - IV)

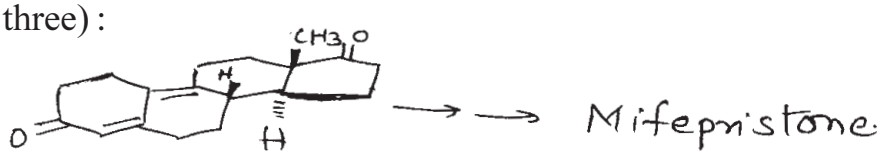
Time :3 Hours] ***[Max. Marks :80***

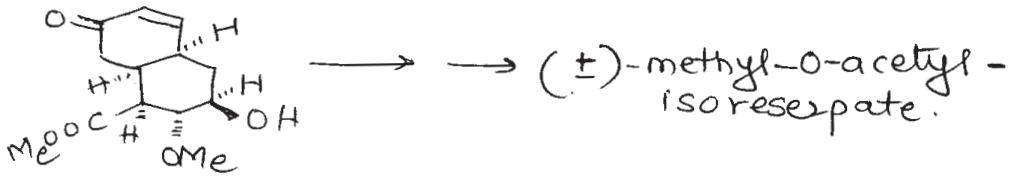
Instructions to the candidates :

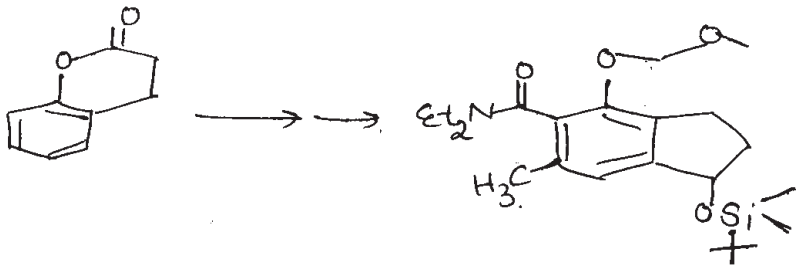
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

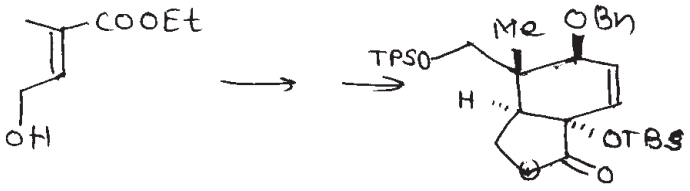
SECTION - I

Q1) a) Outline the steps involved in the following synthetic sequences. Indicate the reagents and discuss the mechanism and stereo chemistry involved. (any three) : **[12]**

i) 

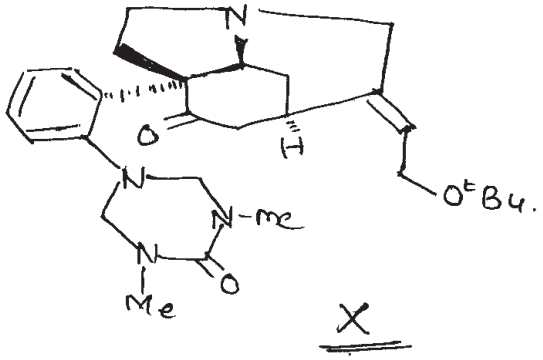
ii) 

iii) 

iv) 

P.T.O.

b) What is aza–Cope–Mannich reaction? Describe the importance of this reaction in the formation of X? Justify with appropriate mechanism. **[4]**



X

Q2) Answer the following (any three) : **[12]**

a) What is the role of acetic anhydride in establishing the stereo chemistry at c–8 in Hardwickiic acid?

b) Give chemical and physical evidences to prove the presence of

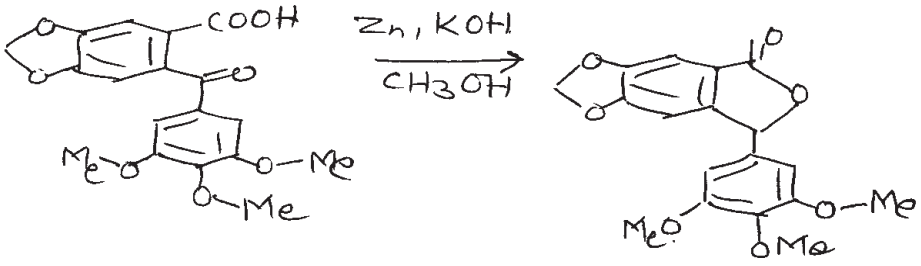
i) Lactone ring and

ii) Tertiary – OH group in camptothecin.

c) Give evidences to establish the relative stereo chemistry of the four possible isomers of deoxy podophyllotoxin.

d) Give the evidences to show the presence of pyrroloquinoline ring in hydroxycamptothecein.

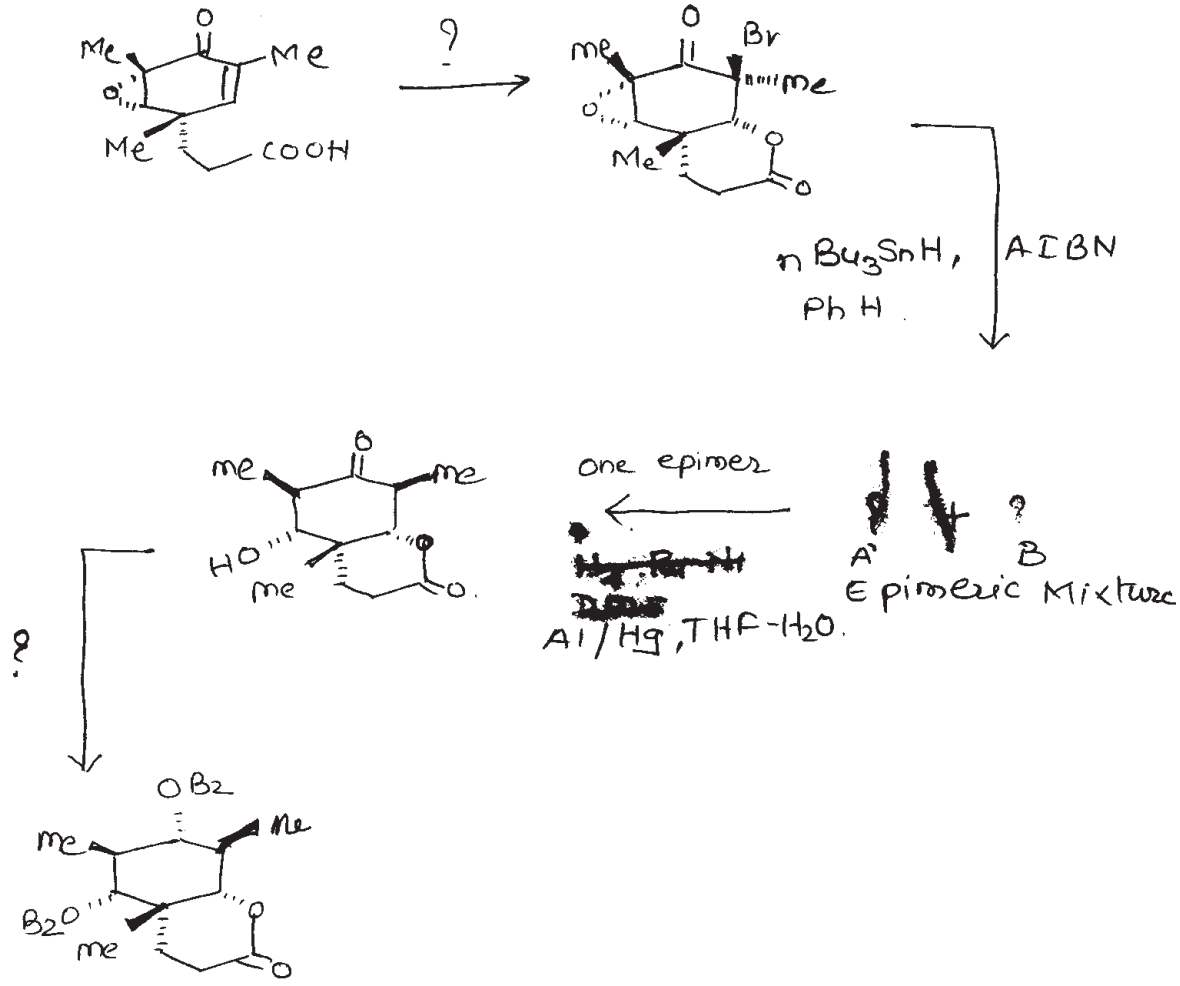
Q3) a) **[6]**



In the above mentioned reaction how will you prove presence of

i) –COOH gr. ii) three –oMe groups iii) $-\overset{O}{\overset{\|}{C}}-$ group? How will you study the course of reaction by IR spectroscopy?

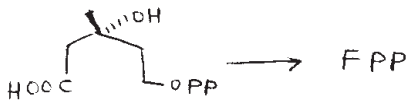
b) Complete the following synthetic sequence. Give mechanism for all steps and write structures of all intermediates involved. **[6]**

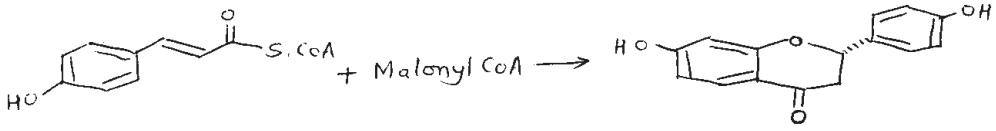


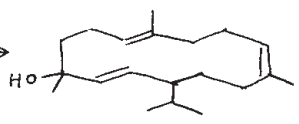
SECTION - II

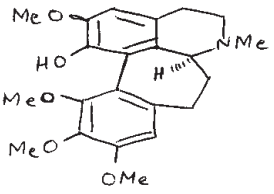
Q4) a) Explain the importance of Wagner–Meerwein rearrangements in biogenesis with suitable examples. **[4]**

b) Suggest biogenetic scheme for <u>any three</u> of the following : **[12]**

i) 

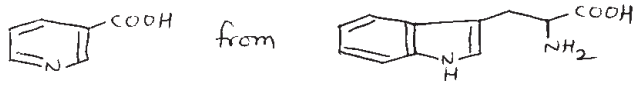
ii) 

iii) Geranylgeranyl pyrophosphate → 

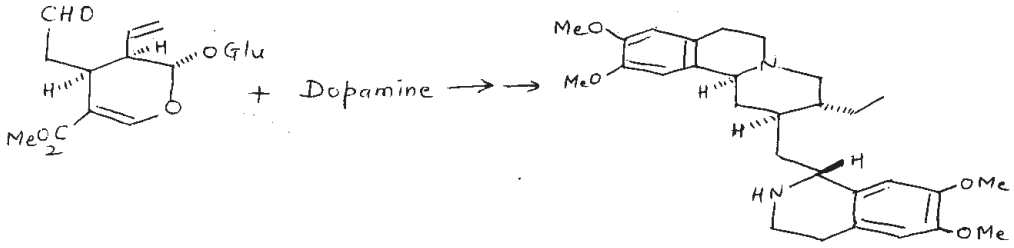
iv) L – Tyrosine ⟶ 

Q5) Answer the following : **[12]**

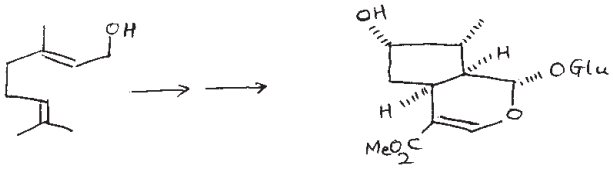
a) Explain the steps involved in the biosynthesis of



b) Explain all the steps involved in the biogenesis of Hardwickiic acid from Geranylgeranyl pyrophosphate.

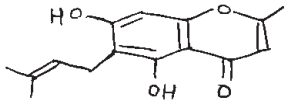
c) 

Q6) a) Suggest the steps involved in the following biogenetic conversion. **[6]**

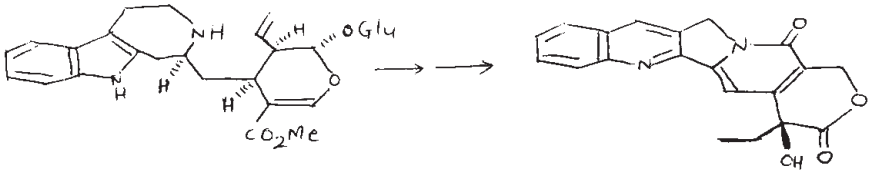


b) Answer <u>any one</u> of the following : **[6]**

i) Write all steps in the following biogenetic conversion.

Acetyl coenzyme A ⟶ ⟶ 

ii) Write the steps involved in the following biogenetic pathway.



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Total No. of Questions : 6] **SEAT No. :**

P426 **[Total No. of Pages : 3**

[4225]-409

M.Sc. - II

ORGANIC CHEMISTRY

CH-451: Synthetic Methods in Organic Chemistry

(2008 Pattern) (Semester - IV)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Explain any four of the following : **[12]**

a) Starting with phenyl alanine and glycine, outline the steps in brief for the preparation of dipeptide Phe-Gly-by the Merrifield method.

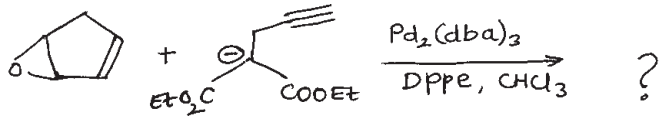
b) For protection of primary alcoholic group in a nucleoside suggest a stable reagent with reasoning.

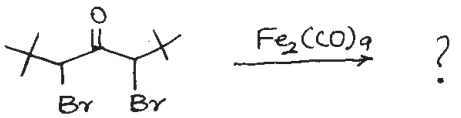
c) Uses of Wilkinson's catalyst in brief.

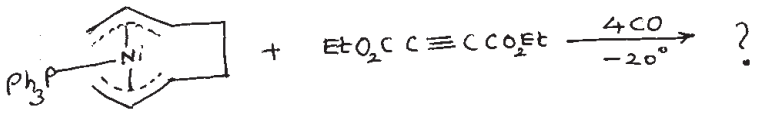
d) Optically active 2-Pentanol can be prepared using hydroboration approach.

e) THP protection of -OH group is stable in basic condition while it is unstable in acidic condition.

Q2) Predict the products in any four of the following : **[12]**

a) 

b) 

c) 

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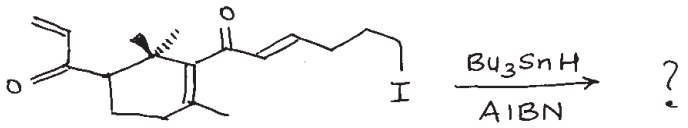
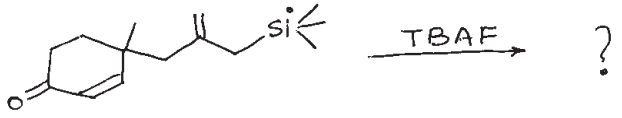
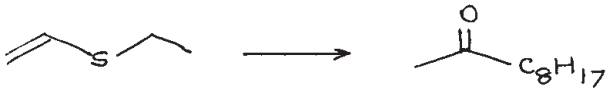
d) 

e) 

Q3) a) Complete <u>any four</u> of the following transformations. **[8]**

i) 

ii) 

iii) 

iv) 

v) 

b) Write short notes on <u>any two</u> of the following : **[6]**

i) Oxo process.

ii) Suzuki coupling.

iii) Use of nitroalkanes in organic synthesis.

c) Explain the use of <u>any one</u> of the following reagent. **[2]**

i) Monoisopinocamphylborane.

ii) Tris-triphenyl phosphine Rhodium chloride.

SECTION - II

Q4) a) Explain <u>any two</u> of the following : **[6]**

i) FMOC group is used for amino group protection during peptide synthesis.

ii) Use of pericyclic reaction in the synthesis of four membered ring compounds.

iii) Reconnection approach in the synthesis of 1, 2-dicarbonyl compounds.

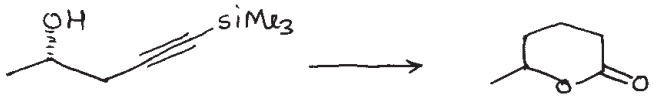
b) Explain the use of <u>any two</u> of the following : **[6]**

i) Acetylenes in organic synthesis.

ii) 1, 3-dithiane in organic synthesis.

iii) Active ester coupling in peptide synthesis.

Q5) a) Complete the following transformation using the reagents given below. Arrange the reagents in proper order (Any two). **[6]**

i) 

TBAF ; BuLi, $ClCO_2Me$; pTSOH, MeOH ;  , pTSOH ; H_2/Pd-C ; pTSOH, PhH

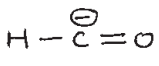
ii) 

MsCl ; H_2, MeOH, PtO_2, Cat. H_2SO_4 ; MnO_2, $CHCl_3$; KI, Zn(Cu), DMF Ph_3CCl ; aq. MeOH, Et_3N

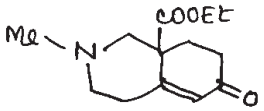
iii) 

PCC, NaOAc ; H_3O^+ ; DHP, H^+ ; $C_5H_{11}MgBr$; MeOH, H^+

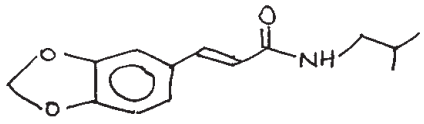
b) Give one reaction with reagent for each synthon given below : **[6]**

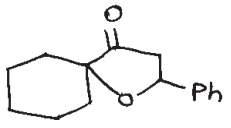
i)  ii)  iii) 

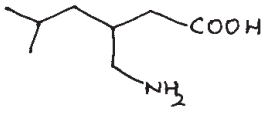
Q6) Using retrosynthetic analysis, suggest a suitable method to synthesize <u>any four</u> of the following : **[16]**

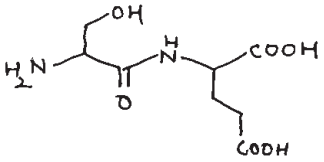
a) 

b) 

c) 

d) 

e) 

f) 

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Total No. of Questions : 6] **SEAT No. :**

P427 **[Total No. of Pages : 4**

[4225]-410

M.Sc.

ORGANIC CHEMISTRY

CH - 452 : Heterocyclic Chemistry Chiron Approach and Medicinal Chemistry

(2008 Pattern) (Semester - IV)

Time :3 Hours] ***[Max. Marks :80***

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) a) Explain the following concept of supramolecular chemistry **[3]**

i) Molecular recognisation & complexation.

ii) Templete directed synthesis.

b) Explain the following any three : **[9]**

i) Benzofuran is more stable than Furan towards acid.

ii) Quinoline is used as a solvent in decarboxylation reactions.

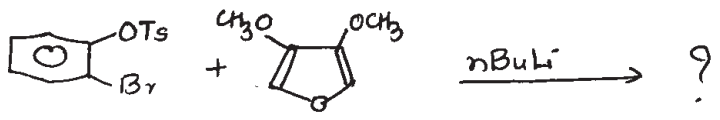
iii) Imidazole undergoes electrophilic substitution only under vigorous conditions.

iv) Electrophilic substitution in 4 - Phenyl Pyridine occurs in the benzene ring.

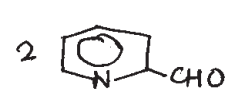
Q2) a) Give the reactions of following reagents with thiophene - **[4]**

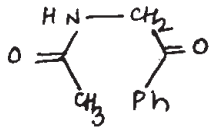
i) HNO_3, Ac_2O, AcOH, 0ºC
ii) $ClSO_3H$, PCl_5 R.T
iii) I_2, aq.HNO_3, 90ºC
iv) HCHO, CHCl, 0ºC

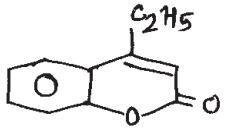
b) Predict the product/s in any five of the following : **[10]**

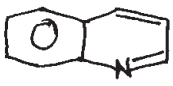
i) 

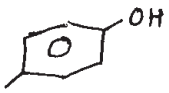
P.T.O.

ii)  KCN, EtOH → ?

iii)  H_2SO_4, Δ → ?

iv)  i) Br_2, $CHCl_3$ ii) aq. NaOH iii) $-CO_2$ → ?

v)  i) $KMnO_4$ ii) Δ, $-CO_2$ → ?

vi)  i) $ClCH_2COOH$, NaOH, Δ ii) PPA, Δ → ?

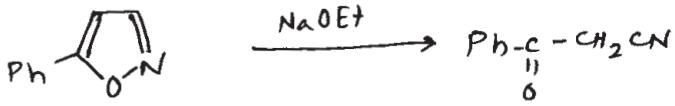
Q3) a) Write notes on <u>any two</u> : **[4]**

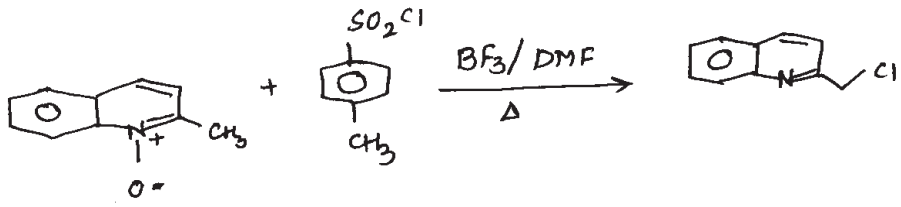
i) Madelung Indole Synthesis.

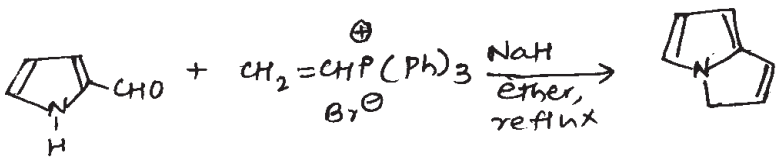
ii) Hinsberg thiophene Synthesis.

iii) Hantzsch Pyrrole Synthesis

b) Suggest suitable mechanism for <u>any two</u> of the following : **[6]**

i) 

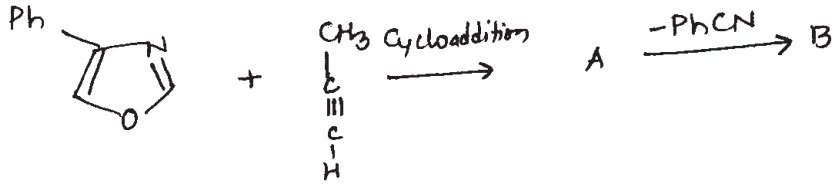
ii) 

iii) 

c) Complete the following reaction sequence <u>any two</u> : **[4]**

i) 

ii) 

iii) 

SECTION - II

Q4) Answer <u>any three</u> of the following : **[12]**

a) Osazones are converted to 1,2 - dicarbonyl compounds called Osones by the reaction with PhCHO. Use this reaction for the conversion of D - Glucose to D - Fructose.

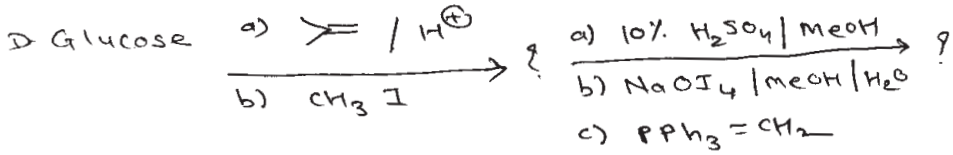
b) Reaction of D-Glucopyranose with MeOH/$H^{\oplus}$ furnish only α - methoxy -D - Gluco Pyranose. Explain the stability of this product with respect to anomeric effect.

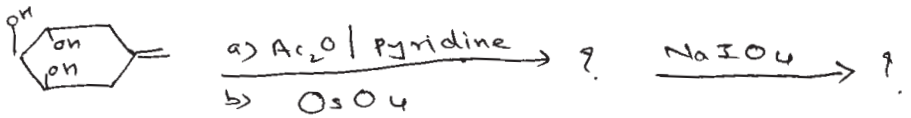
c) Give the reaction sequence for the conversion of aldopentose to aldohexose using Kiliani Fischer synthesis.

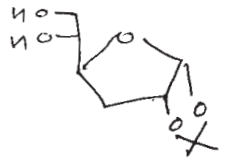
d) Three isomers of D - Arabinose on reaction with HNO_3 furnish optically active, inactive and meso dicarboxylic acids. Give the structures of three isomers of D - Arabinose.

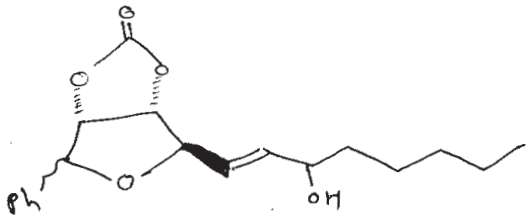
Q5) a) Give the synthesis of L(+) Alanine from α- amino - Z-deoxy - D-Glucose. **[4]**

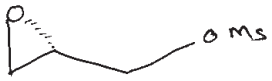
b) Predict the product/s in the following reactions. Explain the mechanism <u>any four</u> : **[8]**

i) 

ii) 

iii)  CH_3NO_2 / Base → A (major) + B (Not formed)

iv)  i) NaH ii) Dihydropyran iii) DIBAL → ?

v)  i) Conc. HCl ii) MeONa / MeOH → ?

c) Give the retrosynthesis of S(–) propanediol. **[2]**

Q6) a) Answer the followings <u>Any two</u> : **[8]**

i) Explain the factors affecting the drug action of the active site.

ii) Give the physico-chemical properties in relation to biological action.

iii) What are the characteristics of ideal drug?

b) Give the concept of atom economy and percentage yield. Calculate the atom economy of the following reaction. Explain the efficiency of the given reaction. **[6]**

$R–CH_3 + 2Cl_2 \longrightarrow RCHCl_2 + 2HCl$ [R = PhCo].

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Total No. of Questions : 4]

SEAT No. :

P428

[Total No. of Pages : 2

[4225] - 411
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 481 : Bioanalytical and Forensic Science
(2008 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory and carry equal marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic table/non-programmable calculator is allowed.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Outline the procedure for the estimation of total CO_2 content in baking powder.

b) Define rancidity. Outline analytical procedure for estimation of peroxide value.

c) Describe the method for estimation of caffeine from coffee.

d) How is theobromine estimated in cocoa?

e) A sample 2.18gm saccharin tablet was subjected to saccharin estimation and required 1.6ml of 0.11N NaOH. Calculate % of saccharin in sample. (Molecular weight of saccharin = 183.2)

Q2) Attempt any four of the following : **[20]**

a) Give the principle for estimation of protein and describe Lowry's method.

b) What are carbohydrates? How are total carbohydrates estimated from food samples?

c) Discuss chemistry of thiamine with respect to structure, biological functions and principle of estimation.

d) Discuss the method of estimation of phosphatase.

e) A sample of oil weighing 2.6gm was subjected to saponification with 25.0ml of alcoholic KOH. It was titrated with 0.5N Hcl and it required 6ml of titrant. If blank reading is 24.0ml. Calculate the saponification value of oil.

(Give At.Wt. K = 39, O = 16, H =1)

P.T.O.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Discuss the principle of isolation and determination of amphetamine from urine sample.

b) How are barbiturates isolated from biological samples by 'Procedure C'?

c) Give the procedure for isolation and identification of benzodiazepines from whole blood.

d) Write note on 'LSD'.

e) By using gas chromatographic method a sample of barbiturate was analysed. Following data is obtained : -

i) Concentration of known barbiturate = 2.7mg ml^{-1}

ii) Peak area of drug in sample = 6.3 min

iii) Peak area of internal standard = 4.7 min

iv) Peak area of known drug in reference = 3.2 min.

v) Peak area of internal standard in reference barbiturate solution = 8.3 min.

Calculate concentration of barbiturate in the sample.

Q4) Attempt any four of the following : **[20]**

a) Define the terms :

i) COCa derivative.

ii) Psycotropic substance.

iii) Narcotic drugs.

iv) Manufactured drugs.

b) Write note on 'Aurvedic Preparations'.

c) Give requirements of bonded laboratory.

d) State the narcotic drugs and psycotropic substances rules 1985 related to cultivation of opium poppy and production of opium poppy straw.

e) Write note on offences and penalties in the psychotropic substance acts.

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Total No. of Questions : 4]

SEAT No. :

P429

[Total No. of Pages : 2

[4225] - 412
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 490 : Analytical Spectroscopy
(2008 Pattern) (Sem. - IV)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory and carry equal marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic table/non-programmable calculator is allowed.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) What is meant by continuum and line source of electromagnetic radiation? Enlist various sources of electromagnetic radiation.

b) State and explain limiting law. Discuss the instrumental causes of deviation of limiting law.

c) What are ESCA satellite peaks? Discuss the difference between electron shake-up and electron shake-off.

d) 1 'S' electron of Nitrate ion has binding energy 407.4 eV. Calculate the kinetic energy of measured electron, if the incident radiation is K_α line of Mg (9.88 $\mathring{A}$) and the work function of electron spectrometer is 6.8 eV.

e) Calculate the molar absorptivity of complex formed between Cu (I) and 1,10 phenonthroline gave transmittance 33.6% for 6.77×10^{-5} M solution of the complex, when measured in 1cm cell at 435nm.

Q2) Attempt any four of the following : **[20]**

a) Draw schematic diagram of X-ray absorption instrument and explain the major components of instrument.

b) State principle of X-ray diffraction technique and explain X-ray powder camera for X-ray diffraction qualitative analysis.

c) What is meant by gas phase chemiluminescence? How gas phase chemiluminescence used in analysis.

P.T.O.

d) Expain the following terms :

i) Singlet and triplet state.
ii) Resonant Fluorescence.
iii) Intersystem crossing.

e) The accelerating potential in a X-ray tube was 25.0kV. Calculate the short wave-length cutoff of the lamp.
(Given : e = 1.602×10^{-19}C)

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Write a critical note on nuclear over hauser effect in NMR.

b) Mention references used in NMR spectroscopy. Give the significance of reference compound in resonance spectroscopy.

c) What is meant by multiple resonance? Explain the concept of Homonuclear, Heteronuclear and Internuclear double resonance technique.

d) The magnetic moment of ^{31}P is equal to 1.1305 nuclear magnetons. Calculate it's magnetogyric ratio and the g-factor.
(Given : N = 5.05×10^{-27} J T^{-1} and Nuclear spin of ^{31}P is + 1/2)

e) The PMR of a compound with empirical formula $C_9H_{11}Br$ shows singlet at 7.22δ, triplet at 3.38δ, triplet at 2.75δ and quintet at 2.15δ. The integration of each peak shows 5 : 2 : 2 : 2 ratio respectively. Identify the compound.

Q4) Attempt any four of the following : **[20]**

a) Explain with the help of examples, the use of spin label technique in EPR.

b) Write a critical note on ENDOR and ELDOR techniques in ESR spectroscopy.

c) Explain the principle of scanning electron microscope with schematic diagram. Give it's advantages.

d) Explain the following terms :

i) g-factor in ESR.
ii) Hyperfine Splitting.

e) Calculate the frequency of radiation to excite free electron at a magnetic flux density of 0.55 T.
(Given : g-factor for free electron = 2.0023,
Bohr magneton = 9.274×10^{-24} JT^{-1}).

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Total No. of Questions : 4]

SEAT No. :

P430

[Total No. of Pages : 2

[4225] - 413
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 491 : Polymer Technology
(2008 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates :

1) ***All questions are compulsory and carry equal marks.***
2) ***Answer to the two sections should be written in separate answer books.***
3) ***Draw diagram wherever necessary.***

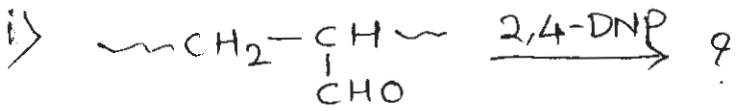
SECTION - I

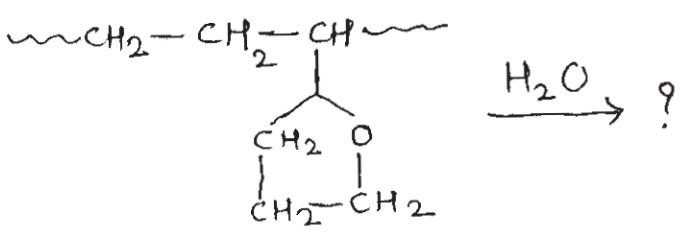
Q1) Attempt any four of the following : **[20]**

a) Explain with example how polymers can be classified on the basis of their behaviour towards heat.
b) Explain salient features of bulk polymerisation.
c) Derive kinetic rate equation for cationic chain polymerisation.
d) Discuss the application of radiation induced polymerisation in polymer composites and curing.
e) Write a note on photodegradation.

Q2) Attempt any four of the following : **[20]**

a) Write a note on Interfacial Condensation.
b) Give method of preparation and uses of
   i) Polyethylene.
   ii) Polyesters.
c) Complete the following reactions.

i) 

ii) 

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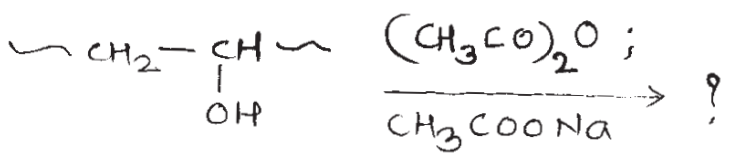
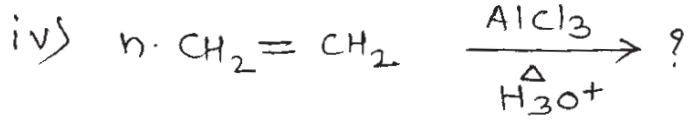
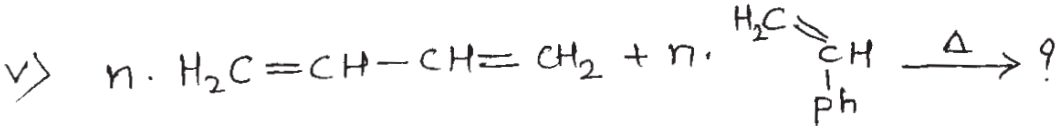
iii) 

iv) 

v) 

d) Discuss the various methods for generation of free radicals.

e) The monomer reactivity ratios of styrene and vinyl acetate are 55 and 0.01 respectively. What is the instantaneous composition of the polymer formed when 3 moles of styrene and one mole of vinyl acetate are co-polymerised?

SECTION - II

Q3) Attempt <u>any four</u> of the following : **[20]**

a) Explain the role of TGA and DTA in structure determination of polymers.

b) Write a note on vulcanization.

c) What is ageing? Mention the reactions encountered in ageing and explain any one method used for ageing.

d) Explain the following terms :

i) Impact test.

ii) Tear and Abrasion resistance.

e) Calculate $\overline{Mn}$ and $\overline{Mw}$ for a polydispersed composed of the following mixture of fractions (mass % and molecular weight of each of the fractions are given) :

Mass % ----------	20	30	50
Molecular weight ----------	50,000	1,00,000	2,00,000

Q4) Attempt <u>any four</u> of the following : **[20]**

a) Discuss the optical properties of polymers.

b) Describe with a neat diagram, the high speed membrane osmometer method for determination of polymer molecular weight.

c) Explain in detail melt spinning process.

d) Explain the role of plasticizers with suitable examples in plastics.

e) The intrinsic viscosity of myosine is 317cm^2/gm, calculate approximate concentration of myocine in water, which would have a relative viscosity of 1.5

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Total No. of Questions : 6]

SEAT No. :

P434

[Total No. of Pages : 4

[4227]-304

M.Sc.

DRUG CHEMISTRY

CH-364: Stereo Chemical Principles and Applications

(2008 Pattern) (Semester - III)

Time :3 Hours] *[Max. Marks :80*

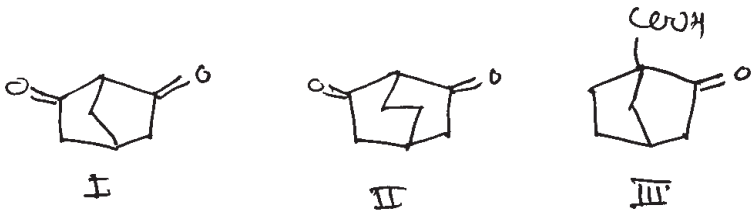
Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Answer any Four of the following : **[16]**

a) Why compound I & II do not show acidic properties & compound III do not undergo decarboxylation with string biose?



I II III

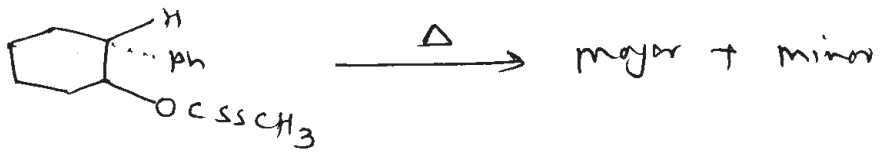
b) Cis 4-hydroxy cyclohexane carboxylic acid lactonise while trans isomer does not. Explain.

c) Cholestan-3β. 7α-diol with excess of ethyl chloroformate yield 3-mono cathylate while cholestan-3β. 7β-diol under similar conditions furnish 3.7-dicathylate. Explain.

d) Why menthyl chloride and neo menthyl chloride with base yield different products?

e) Explain the limitations of Bredt's rule with suitable examples.

Q2) Product the product/s. Explain the stereo chemistry & mechanism (Any Four). **[12]**

a) 

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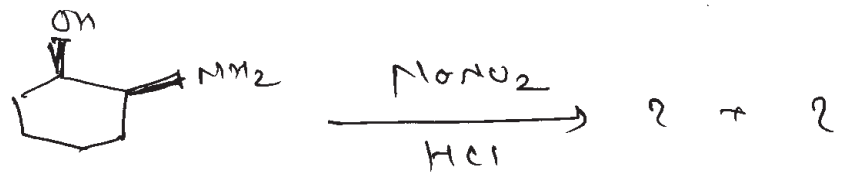
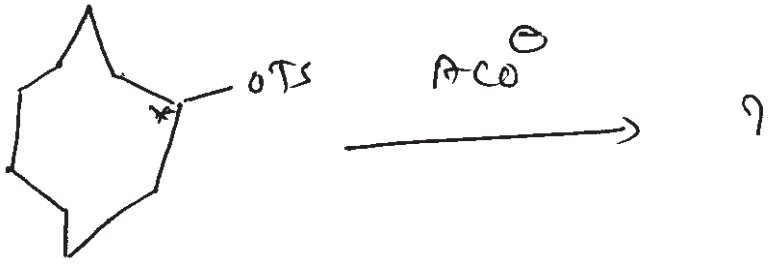
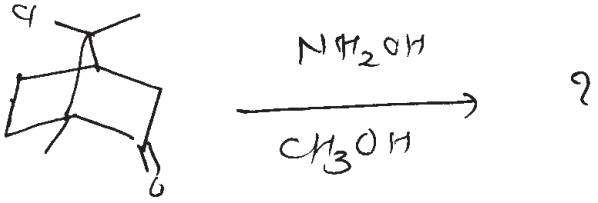
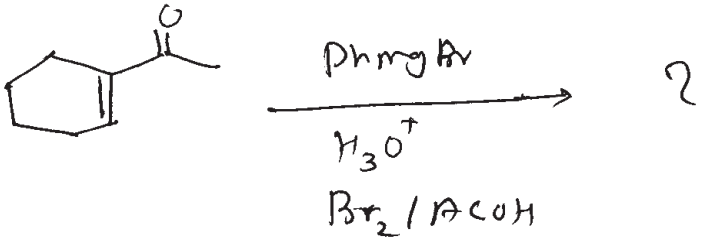
b) 

c) 

d) 

e) 

Q3) Attempt any three of the followings : **[12]**

a) Stereochemistry of epoxide ring closure & ring opening reactions.

b) Explain Transannular interactions.

c) Concept of I-strain.

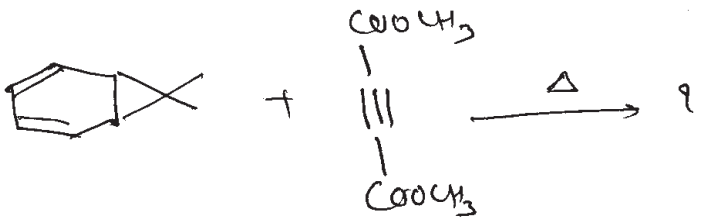
d) Stereo chemistry of bicyclo [3, 3, 1] nomane.

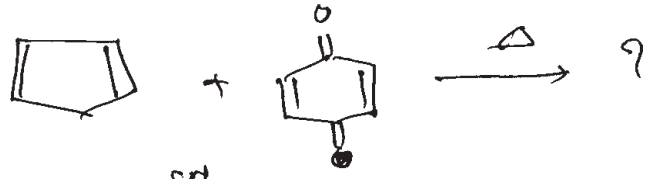
SECTION - II

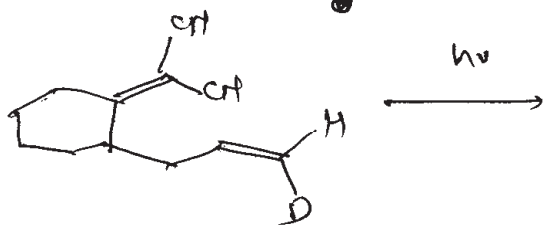
Q4) Attempt the followings :

a) Explain how CON rotatary opening of 1.2 - cyclohexadiene to 1, 3, 5 - hexatriene can be considered as thermally or photo chemically allowed process. **[4]**

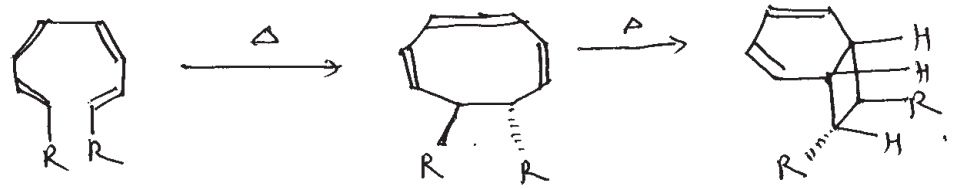
b) Predict the product in any two of the following : **[6]**

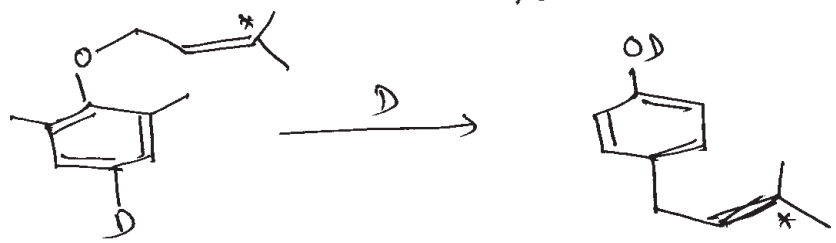
i) 

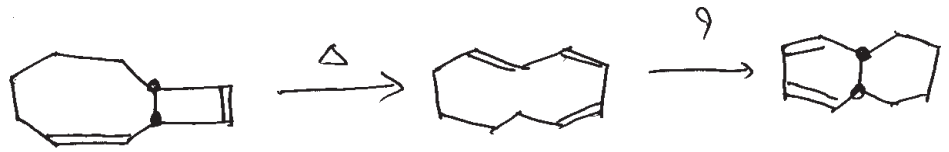
ii) 

iii) 

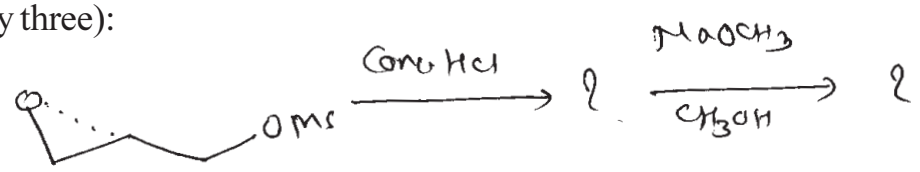
c) Suggest mechanism in any two of the following reactions. **[6]**

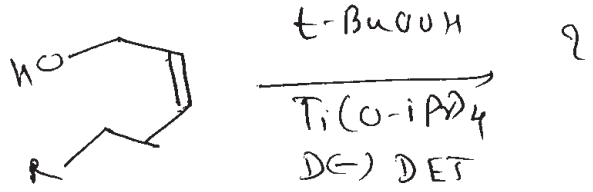
i) 

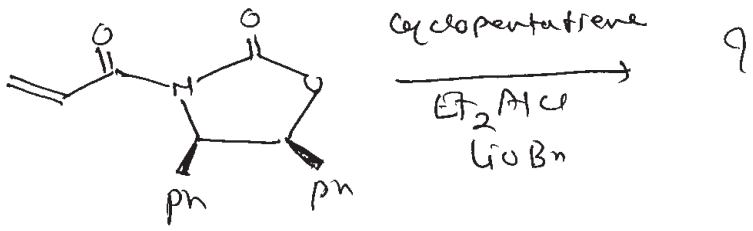
ii) 

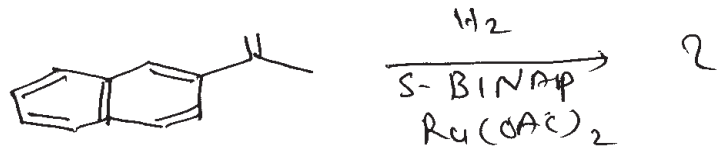
iii) 

Q5) a) Complete the following reactions. Give the mechanism involved (Any three): **[6]**

i) 

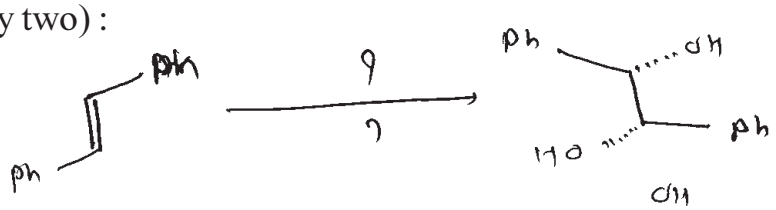
ii) 

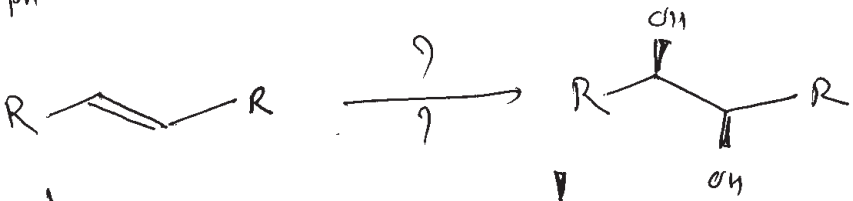
iii) 

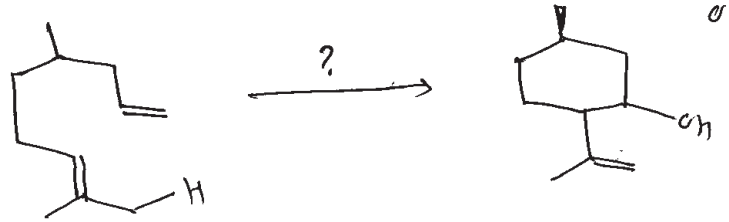
iv) 

b) Explain the term enantiomeric excess and distereomeric excess. How the ee and de are calculated. Explain with example. **[3]**

c) Suggest the reagent and explain stereo chemistry of the following reactions (Any two) : **[3]**

i) 

ii) 

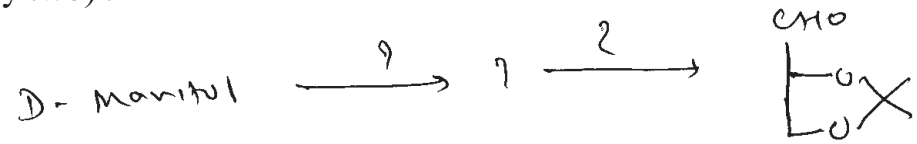
iii) 

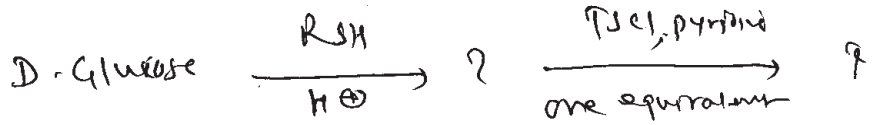
Q6) Attempt the followings :

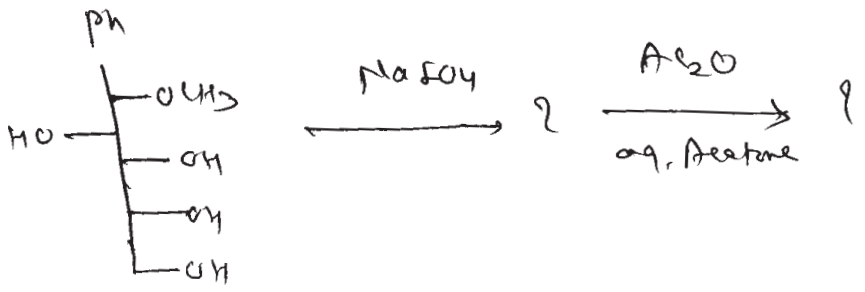
a) Write short note on Chiral Auxillary. **[3]**

b) Give the reaction sequence for the conversion of aldohexose to aldopentose. **[3]**

c) Explain the steps and write the appropriate reagent to achieve the product. (Any two) : **[6]**

i) 

ii) 

iii) 

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